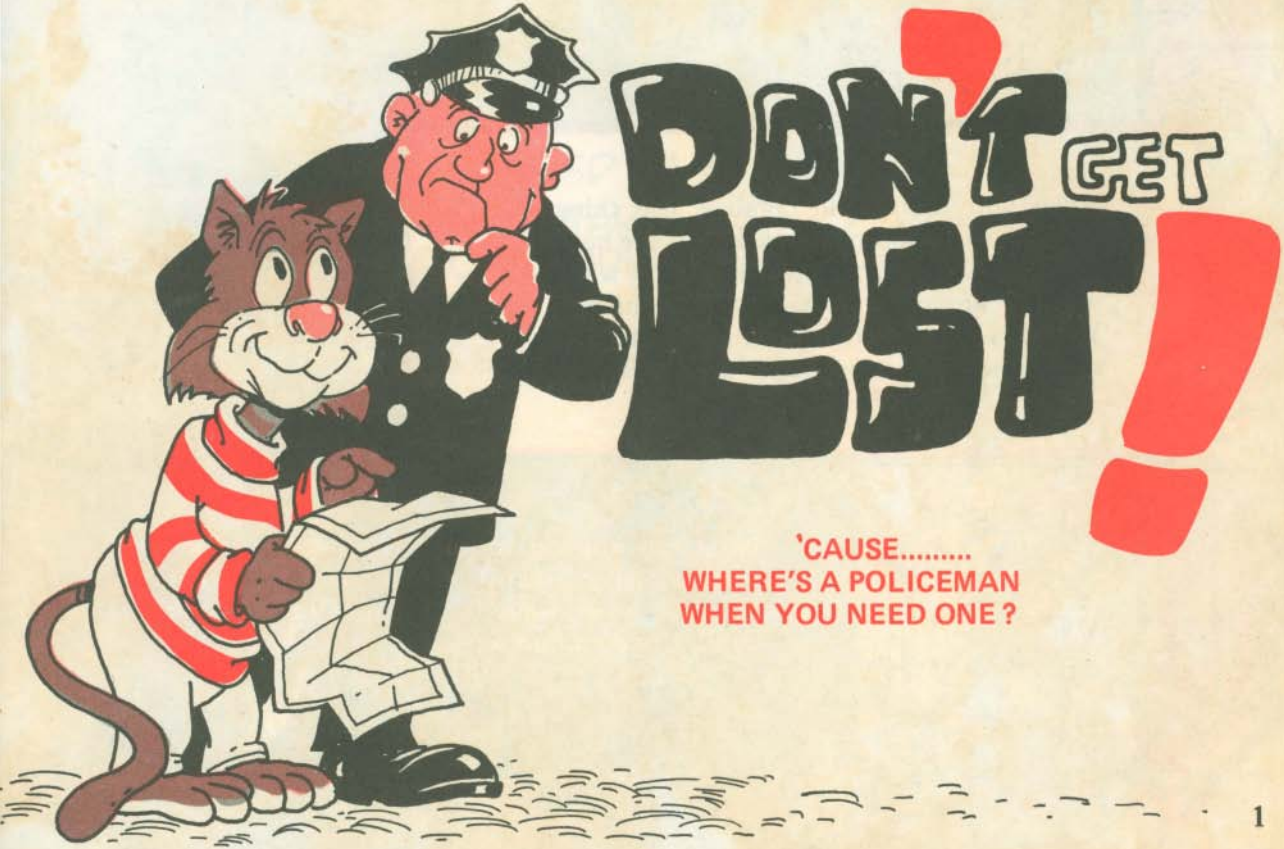
DON'T GET LOST!

HOW TO TRAVEL IN THE BEST CIRCLES IN A SQUARE WORLD

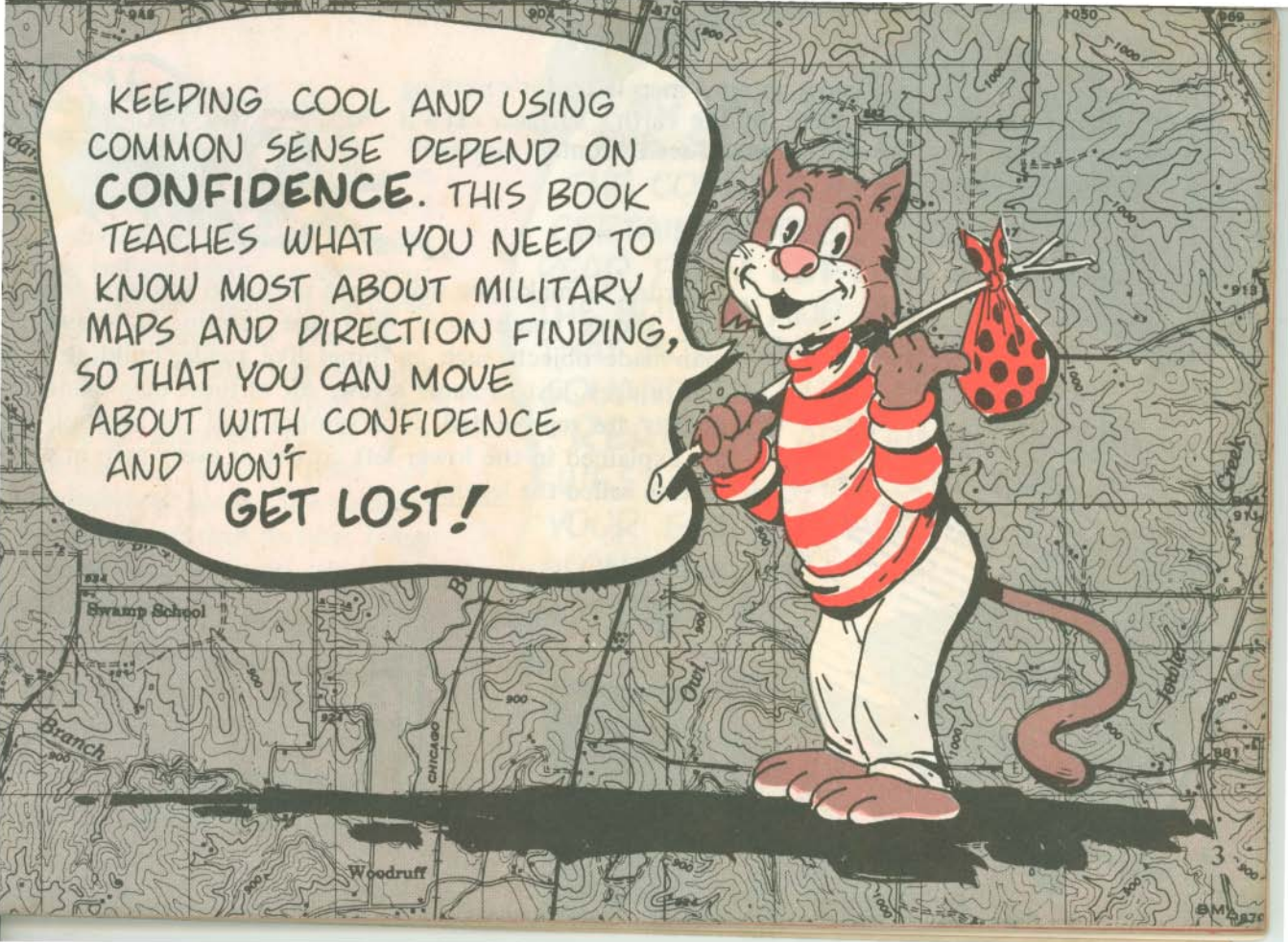
"Don't Get Lost" was written by the US Army Engineer School, Fort Belvoir, Virginia, and is a publication of the US Army Combat Arms Training Board, Fort Benning, Georgia 31905. The information presented herein conforms as closely as possible with approved Department of the Army doctrine and is intended to complement existing doctrinal literature.

FEBRUARY 1973


DON'T GET LOST!
'CAUSE.....
WHERE'S A POLICEMAN
WHEN YOU NEED ONE?

When you get lost in combat, bad things can happen. You may run into some nasty people—the enemy. You may not get where you are supposed to go—fail your mission. You may have trouble getting back to your unit—miss your meals and worry the CO.

What can you do to keep from getting lost? Read a map correctly. Use a compass correctly. Use other ways to find directions. Keep cool. Use common sense.

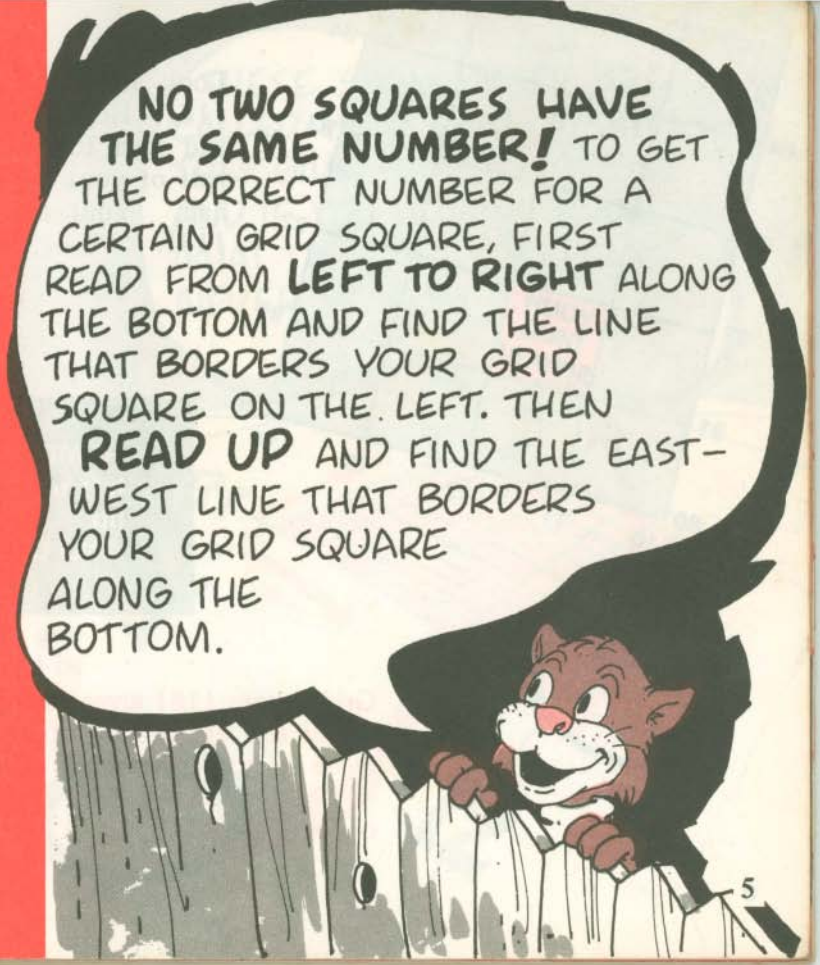

KEEPING COOL AND USING COMMON SENSE DEPEND ON **CONFIDENCE**. THIS BOOK TEACHES WHAT YOU NEED TO KNOW MOST ABOUT MILITARY MAPS AND DIRECTION FINDING, SO THAT YOU CAN MOVE ABOUT WITH CONFIDENCE AND WON'T **GET LOST!**
Swamp School
Branch
Woodruff
Owl
Fodder

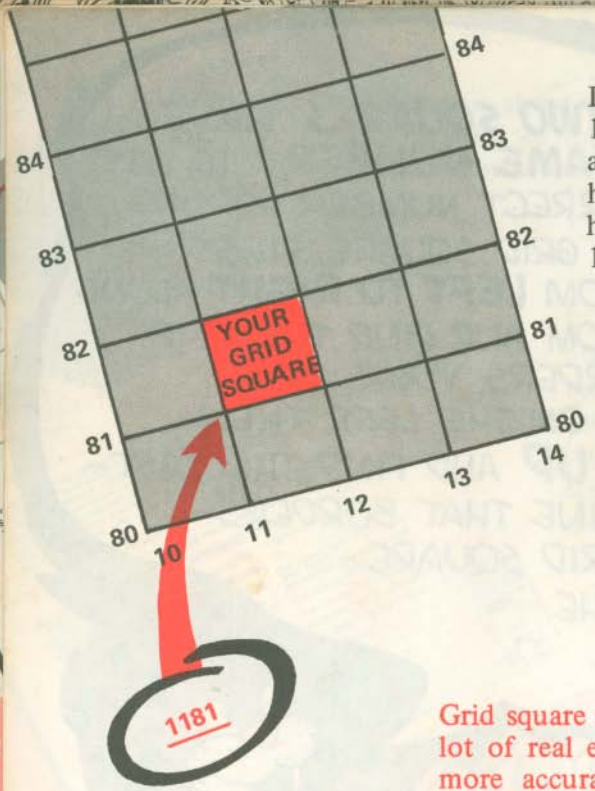
The first thing you should know about a map is that it's nothing more than a drawing of a piece of the earth's surface. It's a drawing made of the earth as you would see it from an airplane—looking straight down.

In order to make the map more useful to soldiers, the map shows much more than just terrain. It shows man-made objects such as things like roads, buildings, and bridges, just to name a few. All of these man-made objects are represented by a symbol, and the symbols are explained in the lower left corner of every map in a section called the legend.

Besides giving symbols for man-made objects, the legend also gives the color code used on the map, and explains the meanings of other symbols which give you an even better idea of what the ground actually looks like. Look at the legend before you begin using the map.

To keep from getting lost in the boonies, you have to know how to find your location—your address. There are no street addresses in a combat area, but the military map can spot your location accurately. It has black lines running up and down (north and south) and crosswise (east and west). They form small squares called grid squares. These lines are numbered along the outside edge of the map picture. Using these numbers, you can name each square.





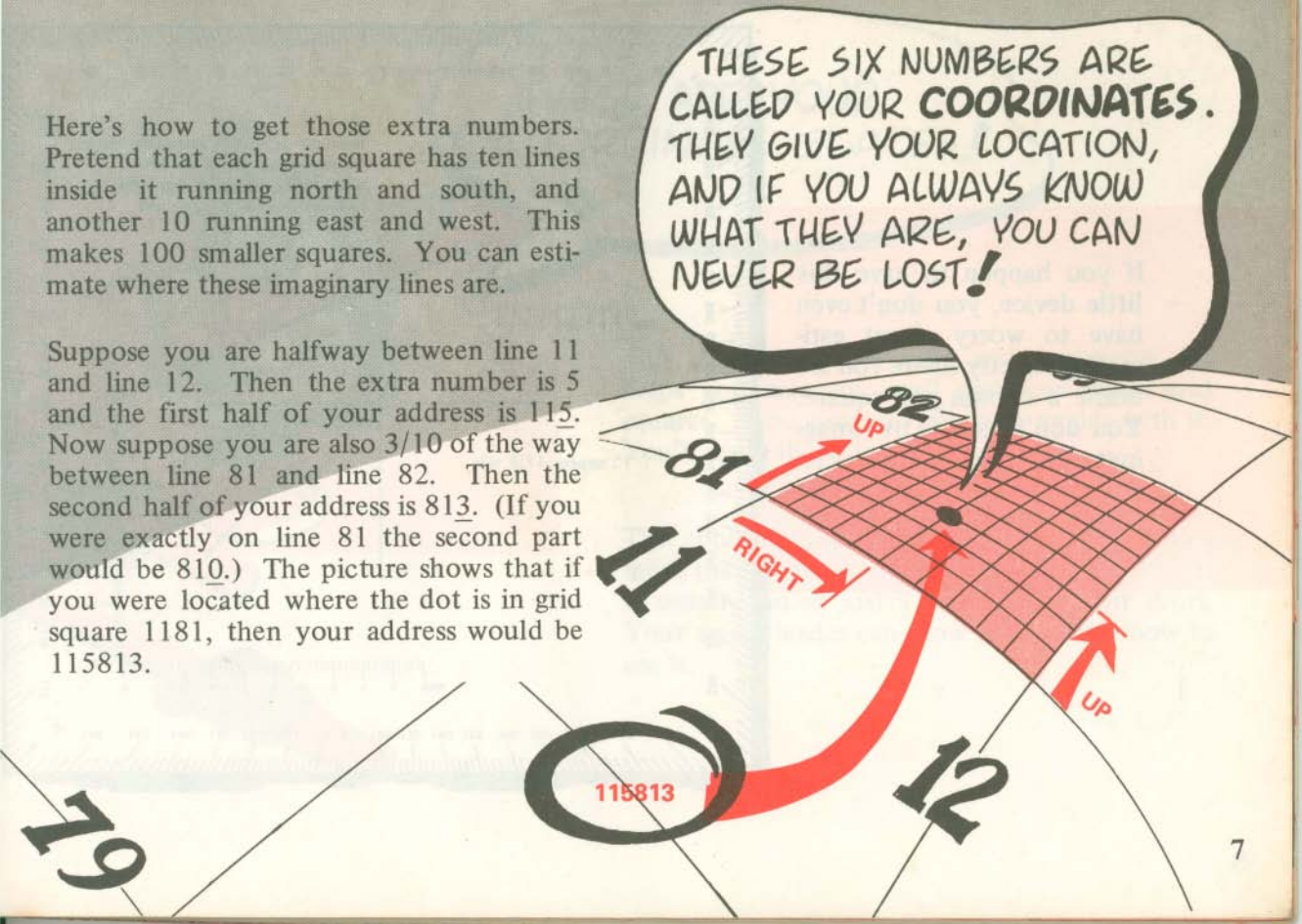
Look at the picture. Your address is grid square 1181. How do you know this? Start from the left and read RIGHT until you come to 11, the first half of your address. Then read UP to 81, the last half. Your address is somewhere in grid square 1181.

REMEMBER: Read left to right, then read up. READ RIGHT AND UP.

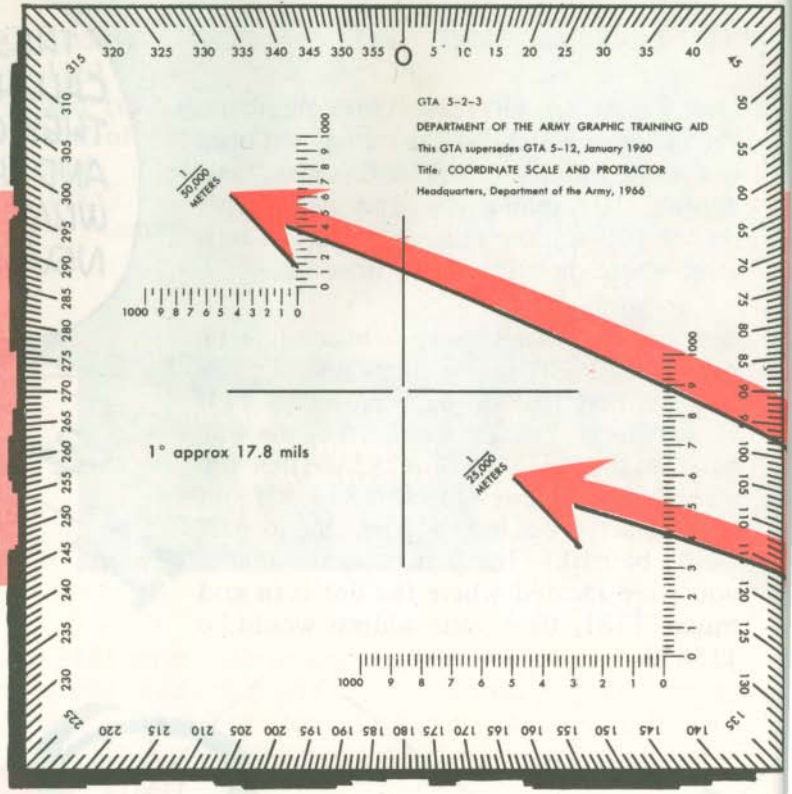
Grid square 1181 gives your general neighborhood, but there is a lot of real estate inside that grid square. To make your address more accurate just add another number to the first half and another to the last half—so your address has six numbers instead of four.

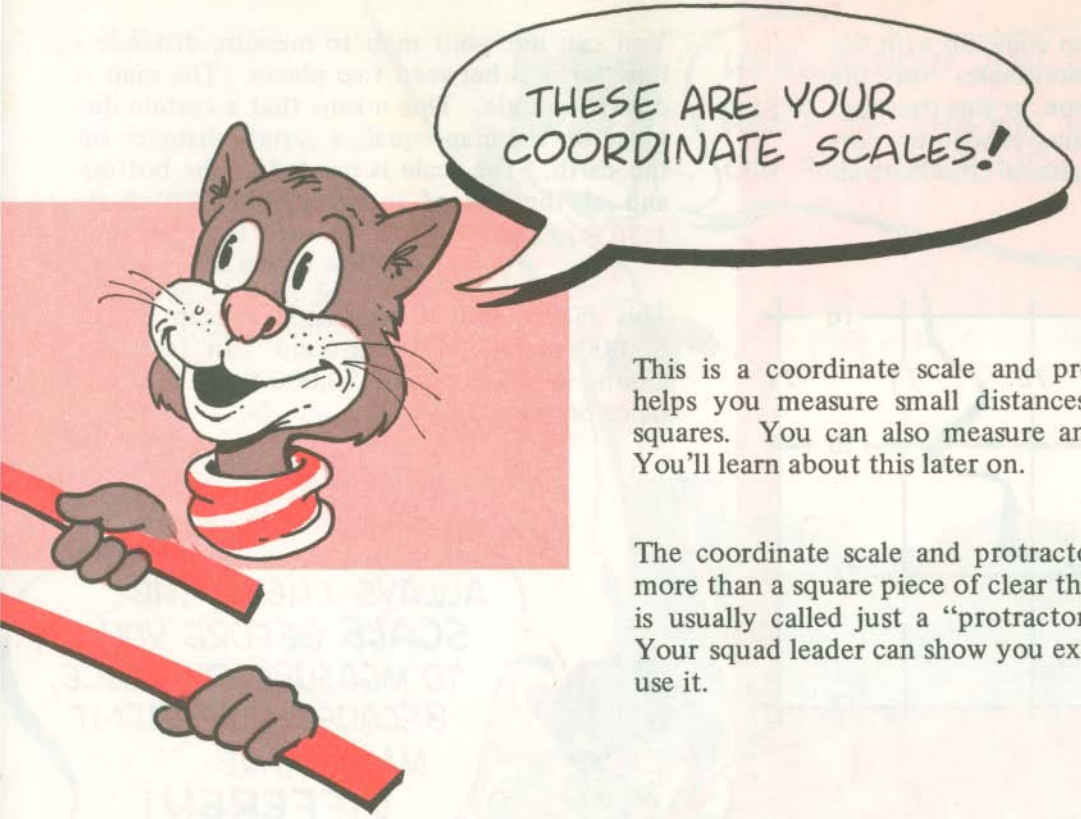
Here's how to get those extra numbers. Pretend that each grid square has ten lines inside it running north and south, and another 10 running east and west. This makes 100 smaller squares. You can estimate where these imaginary lines are.

Suppose you are halfway between line 11 and line 12. Then the extra number is 5 and the first half of your address is 115. Now suppose you are also 3/10 of the way between line 81 and line 82. Then the second half of your address is 813. (If you were exactly on line 81 the second part would be 810.) The picture shows that if you were located where the dot is in grid square 1181, then your address would be 115813.



If you happen to have this little device, you don't even have to worry about estimating exactly where you are inside a certain grid square. You don't have to use imaginary lines, because you can come up with your exact coordinates.

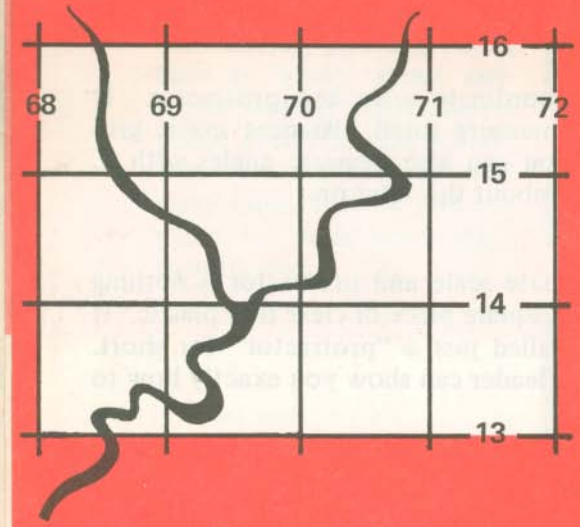




This is a coordinate scale and protractor. It helps you measure small distances inside grid squares. You can also measure angles with it. You'll learn about this later on.

The coordinate scale and protractor is nothing more than a square piece of clear thin plastic. It is usually called just a "protractor" for short. Your squad leader can show you exactly how to use it.

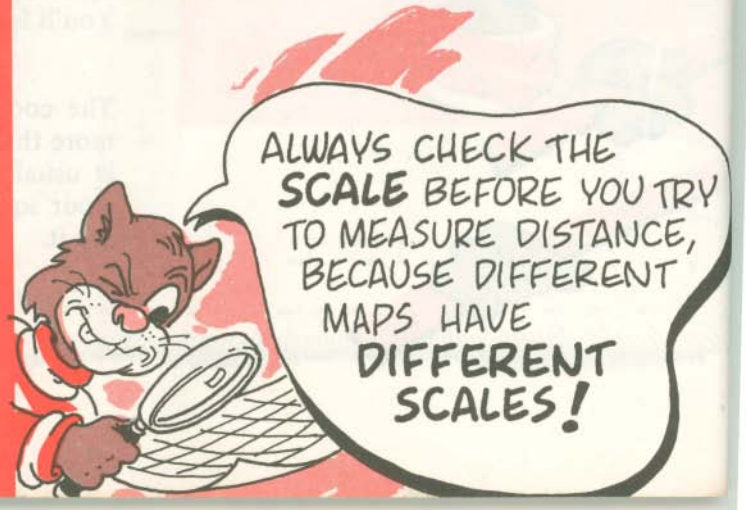
See if you can come up with the 6-number coordinates for the stream junction in this drawing. Check your answer with the correct coordinates at the bottom of the page.



ANSWER: 695140

You can use your map to measure distance—how far it is between two places. The map is drawn to scale. This means that a certain distance on the map equals a certain distance on the earth. The scale is printed at the bottom and at the top of the map, like this—**Scale 1:50,000.**

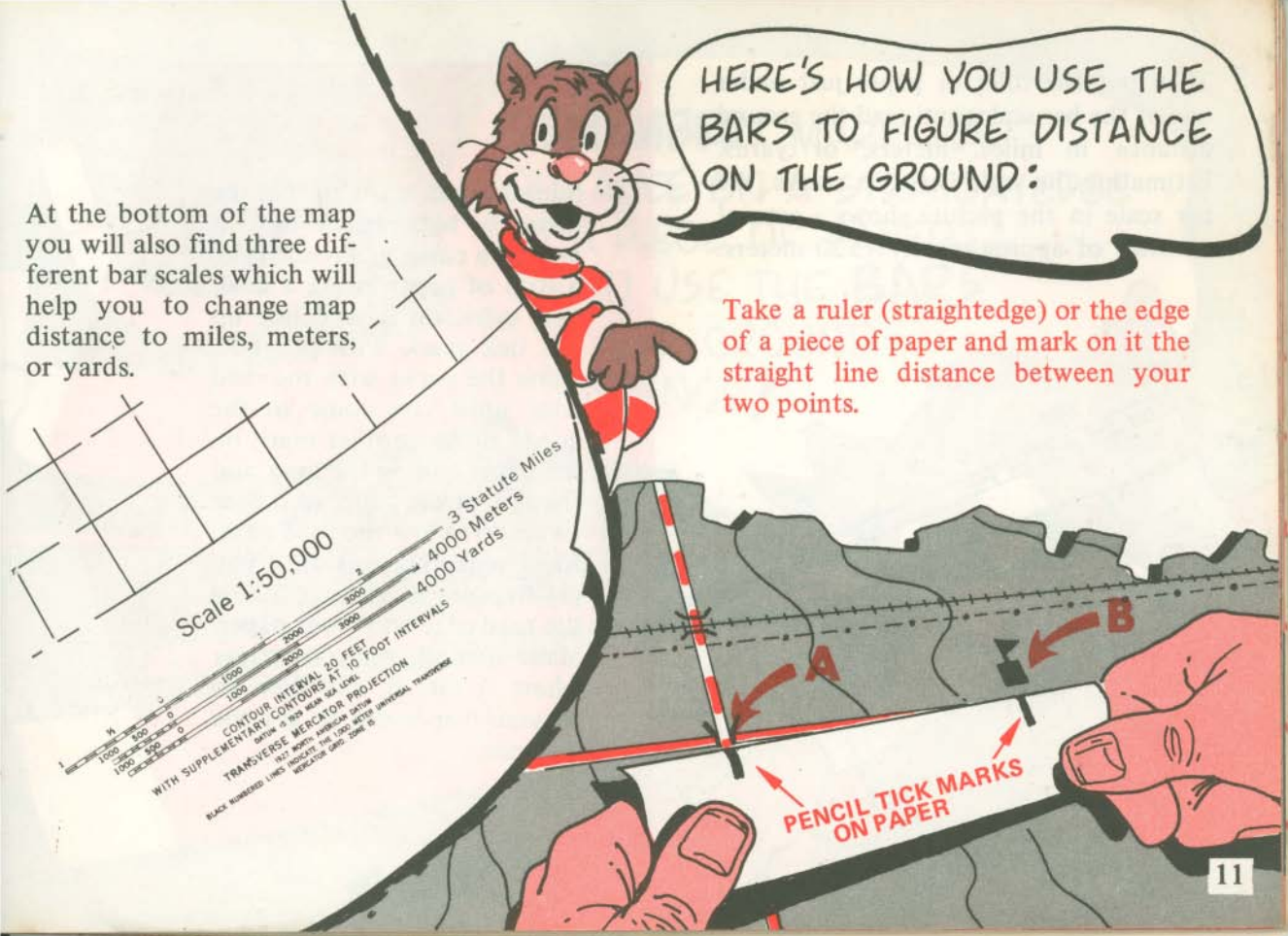
This means that 1 inch on the map equals 50,000 inches on the ground. In fact, any ground distance equals 50,000 times that distance on the map.



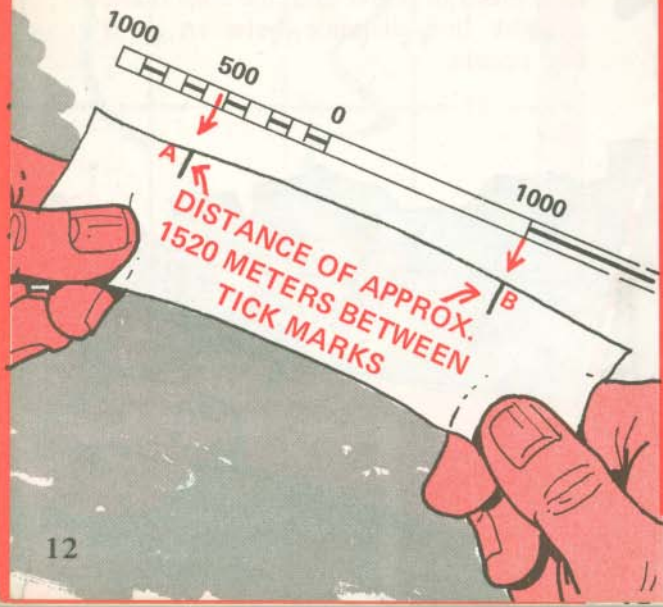
HERE'S HOW YOU USE THE BARS TO FIGURE DISTANCE ON THE GROUND:

At the bottom of the map you will also find three different bar scales which will help you to change map distance to miles, meters, or yards.

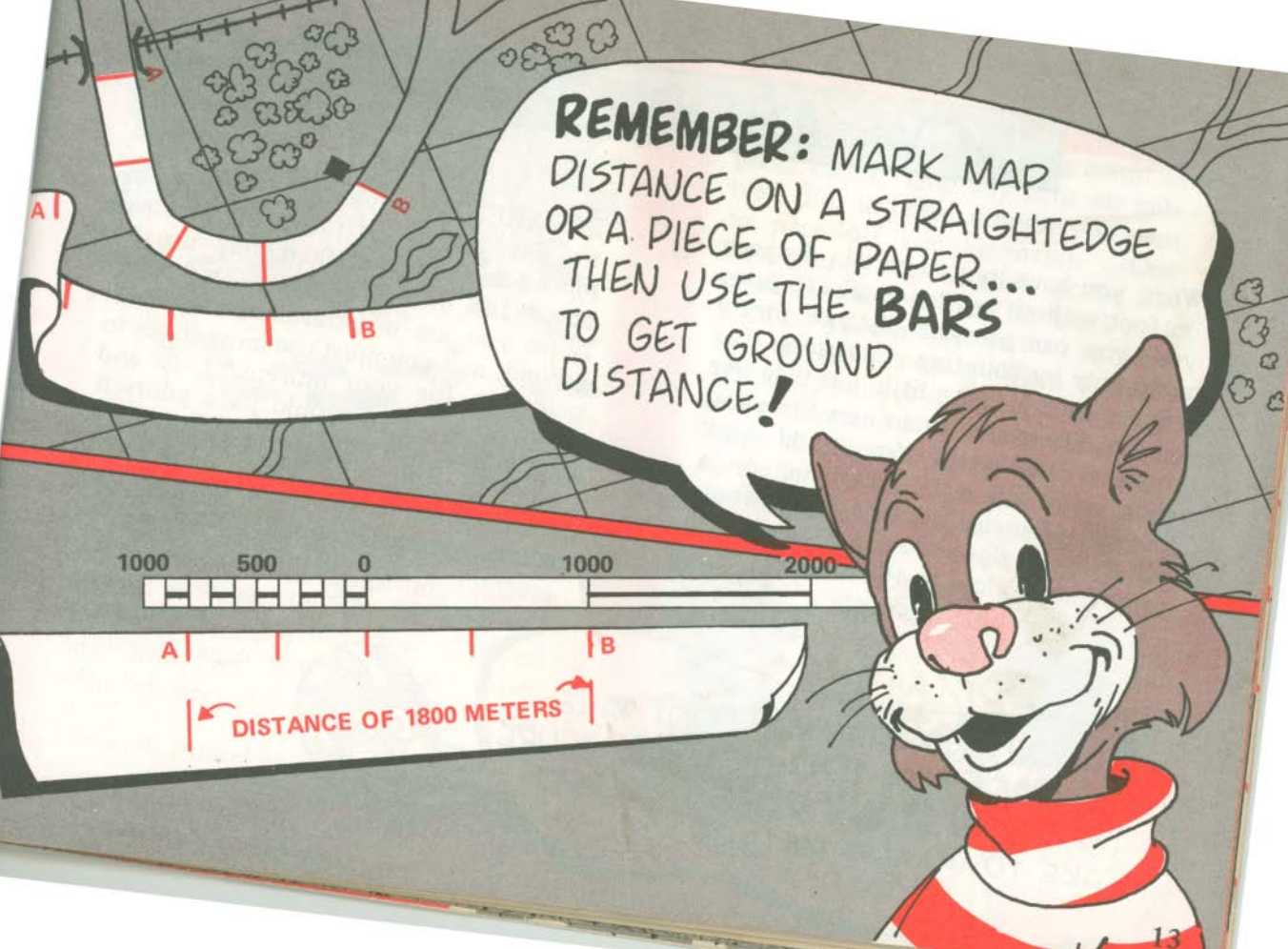
Take a ruler (straightedge) or the edge of a piece of paper and mark on it the straight line distance between your two points.



Then put the ruler or paper just under one of the bar scales and read the ground distance in miles, meters, or yards. Estimating the scale between marks, the bar scale in the picture shows a ground distance of approximately 1520 meters.



Suppose you want to find the distance between A and B around a curve in a road. Take a strip of paper, make a small tick mark on it, and line up the tick mark with point A. Aline the paper with the road edge until you come to the curve, make another mark on the paper and on the map, and then pivot the paper so it continues to follow the road edge. Keep repeating this until you get to point B. Always follow the road edge with your paper. Make a mark on your paper where it hits B, and then go to your bar scales to get the distance.


REMEMBER: MARK MAP DISTANCE ON A STRAIGHTEDGE OR A PIECE OF PAPER... THEN USE THE BARS TO GET GROUND DISTANCE!
A
B
1000
500
0
1000
2000
DISTANCE OF 1800 METERS

NOW, ABOUT PACING...

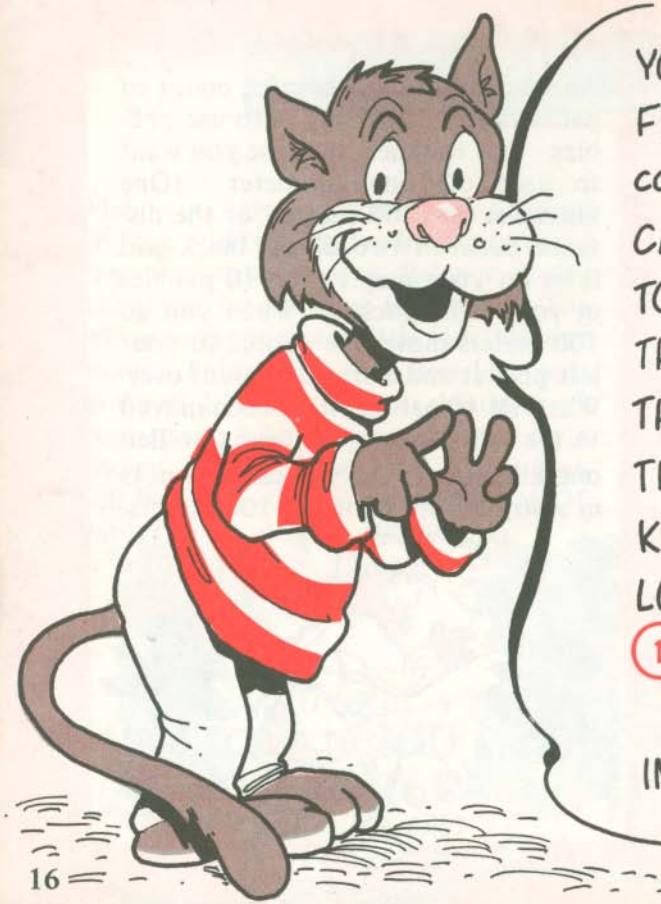
When you have to go a certain distance on foot without any landmarks to guide you, you can measure distance pretty accurately by counting your paces. The average pace is just a little less than one meter. The average man uses 116 paces to travel 100 meters. You should check your pace length by practicing on a known 100-meter distance—like a football field plus one end zone, which is 110 yards (pretty close to 100 meters).

BEWARE: When you travel cross country like you do in the field, you use more paces to travel 100 meters—usually about 148 instead of 116. This is because you are not travelling over level ground, and you must use more paces to make up for your movement up and down hills. You should pace yourself over at least 600 meters of cross-country terrain in order to learn how many paces it takes you to travel an average 100 meters over cross-country terrain.

Be sure you know how many paces it takes you to walk 100 meters both on level terrain and cross country.

The big problem in pacing is maintaining a straight line. At night the average man tends to walk in a circle if he doesn't use a compass. In daylight, you should use a compass and steering points (well-defined objects in your direction of travel toward which you may steer). Also, remember to figure only the straight-line distance when you have to walk around an obstacle.

Another problem is keeping count of paces taken. One way is to use pebbles. For instance, suppose you want to pace off one kilometer. (One kilometer is 1000 meters, or the distance between two of the black grid lines on your map.) Put 10 pebbles in your right pocket. When you go 100 meters move one pebble to your left pocket and start your count over. When all 10 pebbles have been moved to the left pocket, you have travelled one kilometer! Or, you can tie knots in a string—one knot per 100 meters.

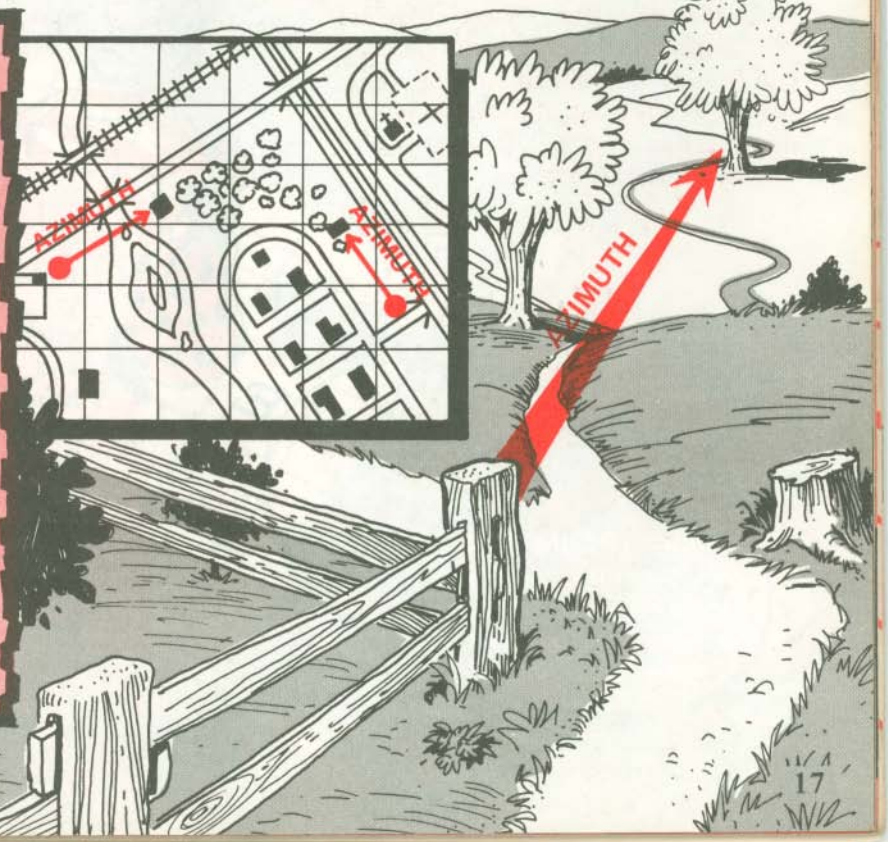


YOU HAVE LEARNED HOW TO FIND **LOCATION** (YOUR MAP COORDINATES). ALSO, YOU CAN USE YOUR MAP SCALE TO FIND **DISTANCE**. THE NEXT STEP IS TO FIND THE CORRECT **DIRECTION**. THESE THREE THINGS WILL KEEP YOU FROM GETTING LOST: — KNOWING YOUR (1) **LOCATION**, MEASURING (2) **DISTANCE**, AND GOING IN THE RIGHT (3) **DIRECTION**!

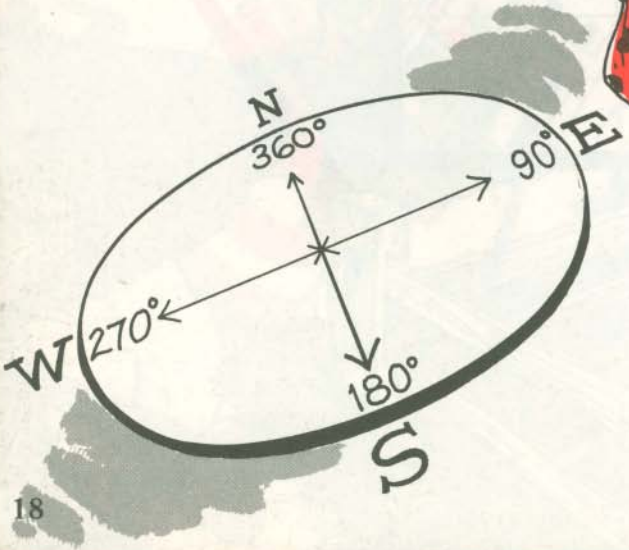
... AND SO, ABOUT DIRECTION...

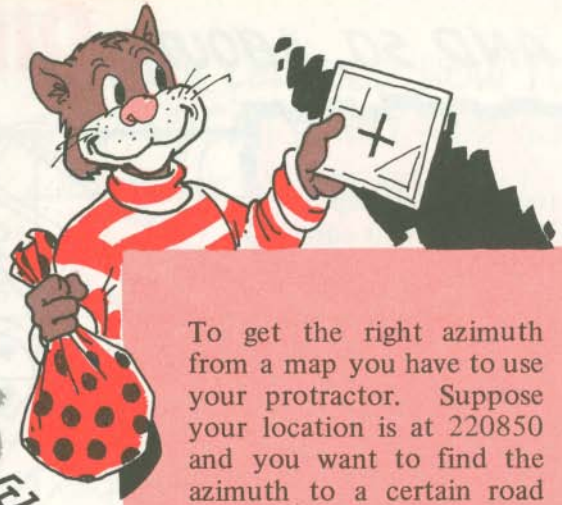
The top of your map is NORTH. The right edge of the map is EAST, the bottom is SOUTH, and the left edge is WEST. The direction from one point to another point (either on the map or on the ground) has a military name–

AZIMUTH

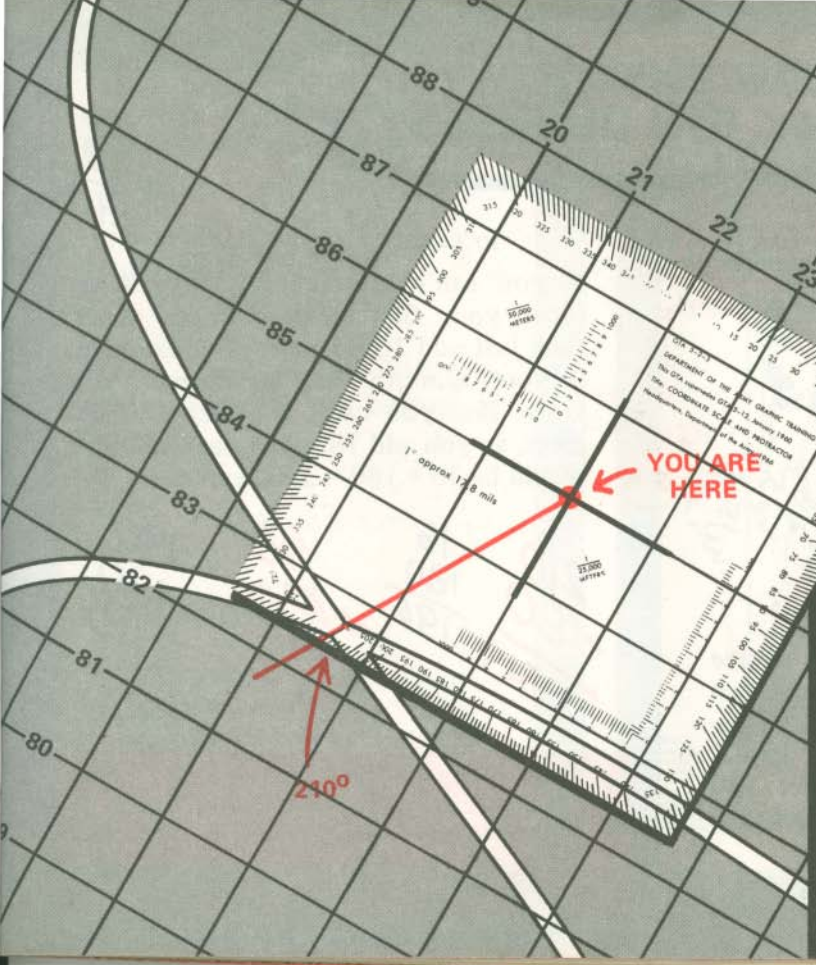


Azimuths are given in degrees in a clockwise direction. Since there are 360 degrees in a circle, your azimuth can be any number up to 360. Due east is 90 degrees, due south is 180 degrees, due west is 270 degrees, and due north is 360 degrees.





To get the right azimuth from a map you have to use your protractor. Suppose your location is at 220850 and you want to find the azimuth to a certain road junction. Draw a line from your location to the road junction. Then place the protractor as shown in the picture, making certain to line it up properly, keeping the cross-center lines of the protractor parallel with the grid lines. Read the azimuth in degrees from the protractor – 210 degrees.



REMEMBER: Aline your protractor up carefully, using the grid lines as guides. Place the protractor index directly over your location.

WHEN YOU TURN AROUND COMPLETELY, YOU TURN BACK **180 DEGREES!**

Suppose you follow the 210 degree azimuth to the road junction, and then want to go back to your original location. To do this, you take a BACK AZIMUTH. You simply subtract 180 from the first azimuth. Your back azimuth is 210 - 180 = 30 degrees.

320
-180
140

60
+180
240

If you can't subtract 180 degrees because your first azimuth is too small, then just add 180 degrees. For example, if your azimuth was 40 degrees, you know that you can't subtract 180 degrees, so you add 180. The back azimuth would be 40 + 180 = 220 degrees.

210
-180
30

16
180
196

40
+180
220

190
-180
10

72
+180
252

REMEMBER: A back azimuth goes in the opposite direction from an azimuth.

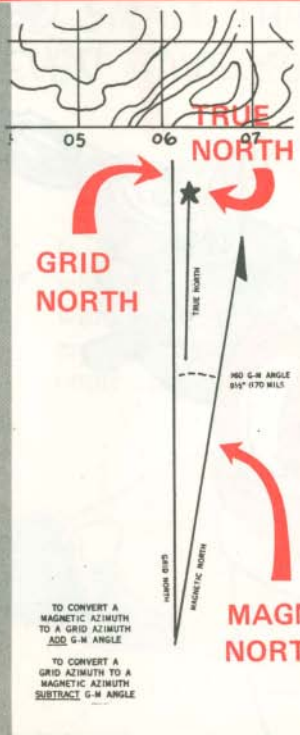
Can you figure out the back azimuth of 290 degrees?

How about the back azimuth of 75 degrees?

Check your answers with the right answers at the bottom of the page.

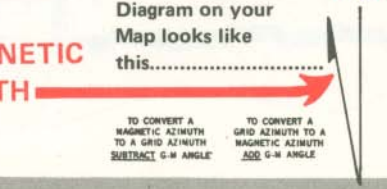
ANSWERS: The back azimuth of 290 degrees is 290 minus 180, which is 110 degrees. The back azimuth of 75 degrees is 75 plus 180, which is 255 degrees.

AND NOW, ABOUT THOSE "3 NORTHS"



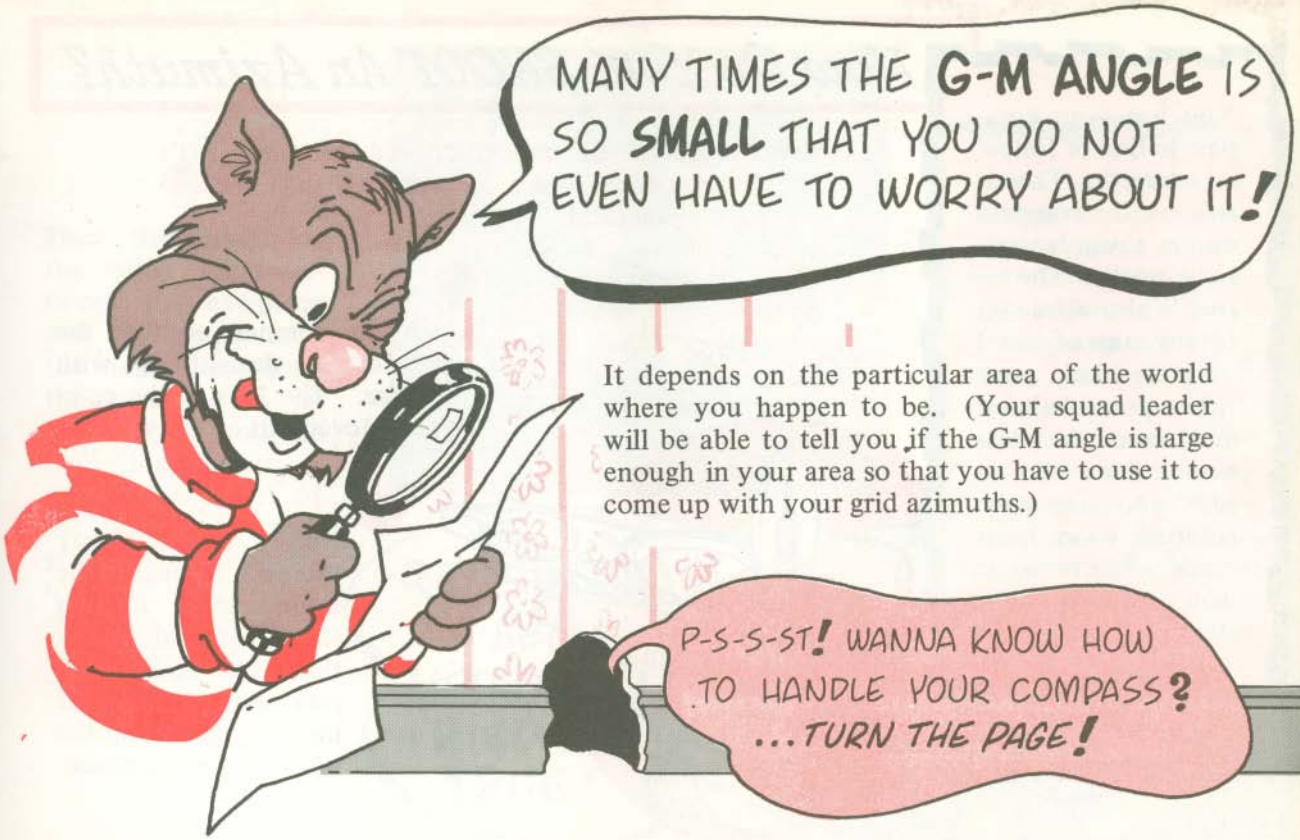
The north-south lines on your map give GRID north. The needle of the compass points to MAGNETIC north. Grid north and magnetic north are usually different by a few degrees. Neither one points straight at the north pole—that's called TRUE north, but you needn't worry about TRUE north to keep from getting lost in a combat area. The difference in degrees for every map is shown at the bottom of the map sheet.

If the Declination Diagram on your Map looks like this.....



The difference between GRID north and MAGNETIC north is called the G-M angle. The diagram at the bottom of newer maps tells you how to change grid azimuths to magnetic azimuths and magnetic azimuths to grid azimuths.

For example, you aim your compass at a distant tower. The compass reading you get is 190 degrees—the MAGNETIC azimuth. The diagram on your map tells you that the G-M angle is 9 degrees, and it also tells you that "to convert a magnetic azimuth to a grid azimuth, add the G-M angle." So, add 9 degrees to your compass reading. This gives you 190 + 9 = 199. Your grid azimuth is 199 degrees.

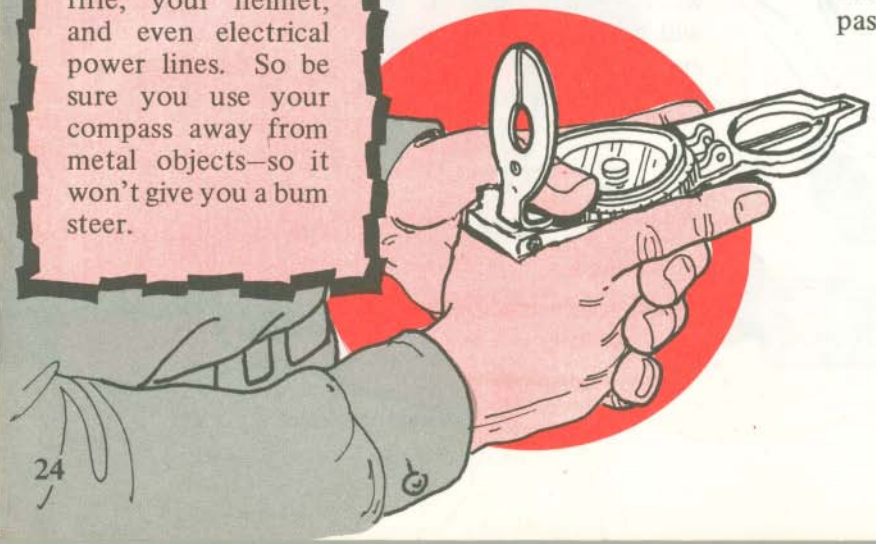


It depends on the particular area of the world where you happen to be. (Your squad leader will be able to tell you if the G-M angle is large enough in your area so that you have to use it to come up with your grid azimuths.)

How Do You SHOOT An Azimuth?

You use your compass to find or follow an azimuth. The arrow on the compass points towards magnetic north. The arrow is also attracted by any mass of metal —a jeep, truck, your rifle, your helmet, and even electrical power lines. So be sure you use your compass away from metal objects—so it won't give you a bum steer.

You gotta' use the center-hold technique! It's faster, easier, and more accurate than the old sighting method.



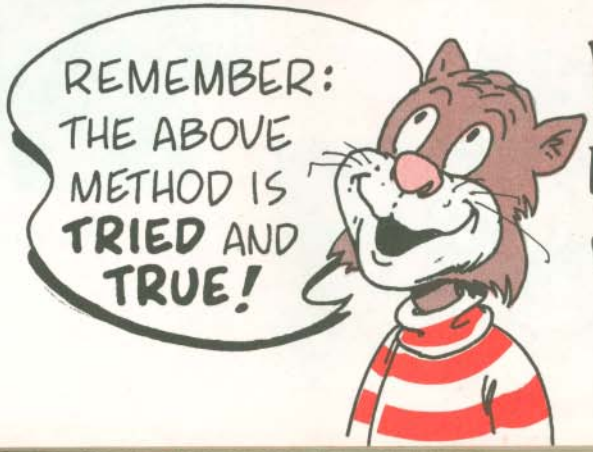
1. Open the compass so that the cover forms a straight edge with the base. The lens of the compass is moved out of the way.

2. Next, place your thumb through the thumb loop, form a steady base with your third and fourth fingers and extend your index finger along the side of the compass.

3

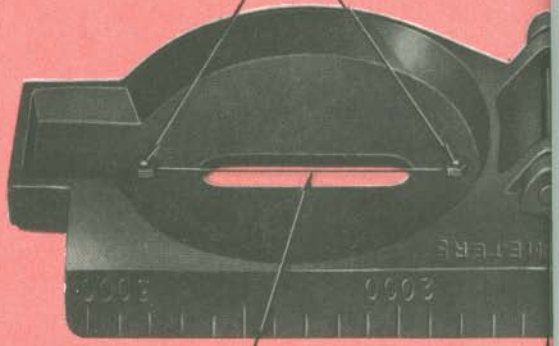
Place the thumb of the other hand between the eye-piece and the lens; extend the index finger along the remaining side of the compass and the remaining fingers around the fingers of the other hand; pull your elbows firmly into your sides. This will place the compass between your chin and your belt.

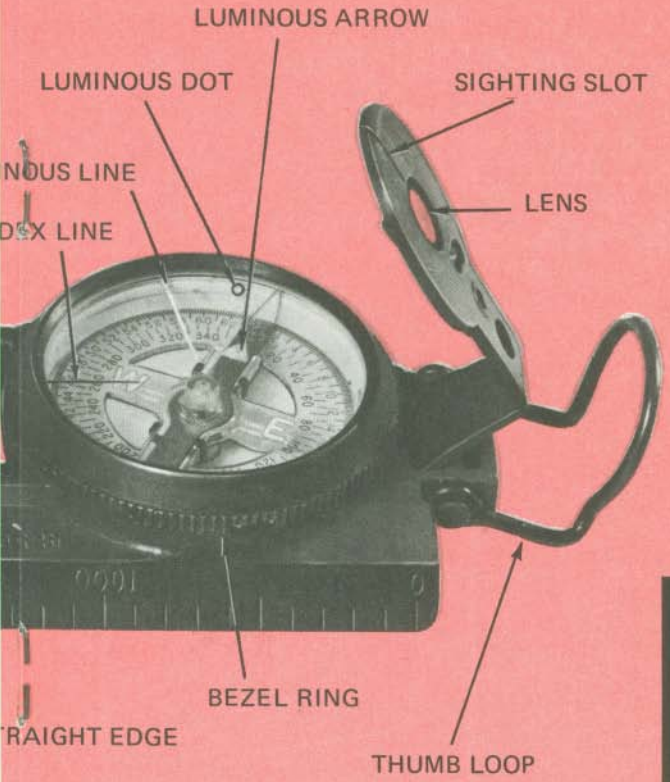
To measure an azimuth, simply turn your entire body toward the object, pointing the compass cover directly at the object. Once you are pointing at the object, just look down and read the azimuth from beneath the fixed black index line. Man, you can even use this method at night!



If you are land navigating, stop occasionally to check the azimuth along which you are moving to keep from going in circles. Also, you can move from object to object along your path of travel by shooting an azimuth to each object and then moving to that object. Repeating this process while you navigate should keep you "straight!"

MAN, IN THIS CRAZY WORLD A GUY JUST **HAS** TO HAVE SOME **DIRECTION.** I WOULDN'T BE **CAUGHT DEAD** (ALL NINE TIMES) WITHOUT MY TRUSTY **COMPASS!**





KNOW YOUR COMPASS

THIS IS THE LENSATIC COMPASS.

BEWARE: Your compass is a sensitive instrument—and it's your best friend in the boonies. Take care of it and it will take care of you!

WELL, NOW YOU KNOW QUITE A BIT ABOUT **HOW** TO USE YOUR **COMPASS** TO KEEP FROM **GETTING LOST.** BUT DO YOU KNOW WHAT REALLY SEPARATES THE **MEN** FROM THE **BOYS?** IT'S KNOWING HOW TO USE THAT TRUSTY OLD COMPASS **AT NIGHT!**

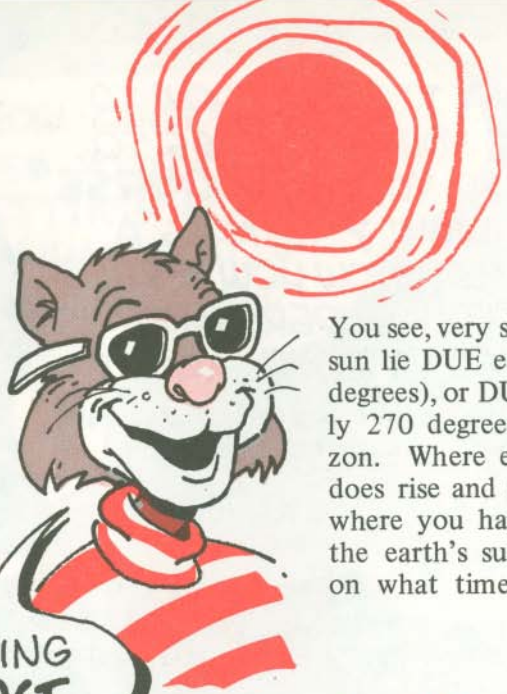
Take another look at the compass on the preceding page. Those luminous lines and luminous dots have a special purpose. See that bezel ring? When you rotate it, you should be able to hear it click. Well, those clicks also have a special purpose, just like the luminous lines and dots. They're all built into the compass to help you set an azimuth on your compass and follow it at night.

WANT TO LEARN HOW TO GET YOUR COMPASS TO KEEP YOU "**ON COURSE**" AT NIGHT? IT TAKES A LITTLE KNOW-HOW — BUT IF YOU UNDERSTAND **EVERYTHING** ABOUT THE COMPASS **SO FAR**, YOU'LL HAVE NO TROUBLE PICKING IT UP!

WHERE DO YOU FIND THE INFO? LOOK FOR THE **CAT** WITH THE **STRIPES** — YOUR **SQUAD LEADER!** HE'LL FILL YOU IN WITH ALL YOU NEED TO KNOW. OR YOU CAN CHECK **FM21-26!**

direction... without a compass

When you have no compass, use the sun to find your direction. You probably remember the old rule that "the sun rises in the east and sets in the west." Well, that's a pretty good rule, but it's not quite right.



You see, very seldom does the sun lie DUE east (exactly 90 degrees), or DUE west (exactly 270 degrees) on the horizon. Where exactly the sun does rise and set depends on where you happen to be on the earth's surface, and also on what time of year it is.

ACTUALLY, IN THE MORNING THE SUN RISES **ALMOST** EAST, AND IN THE AFTERNOON THE SUN SETS **ALMOST** WEST!

So now you're probably asking yourself, "How can I use the sun to find my direction if I don't know exactly where it is?"

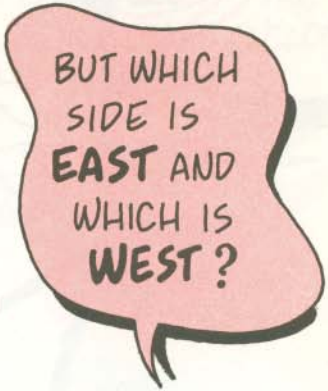
EASY! Just use the SHADOW-TIP field expedient method. It's quick, it's easy, and it's very accurate. Here's how to do it in three simple steps:

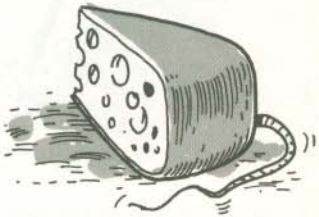
Place a stick or branch into the ground vertically at a fairly level spot where a distinct shadow will be cast. Mark the shadow tip with a stone, twig, or other means.

2

Wait about 10 or 15 minutes until the shadow tip moves a few inches. Mark the new position of the shadow tip just like the first.

Draw a straight line through the two marks which you made on the shadow tips. This line you have drawn is an EAST-WEST line.

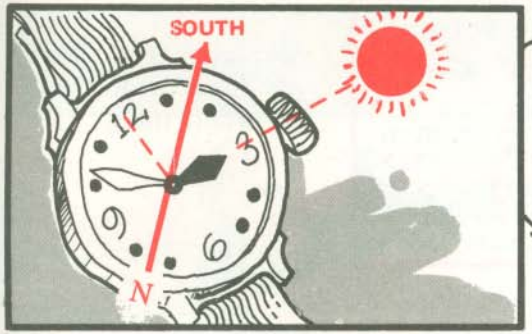




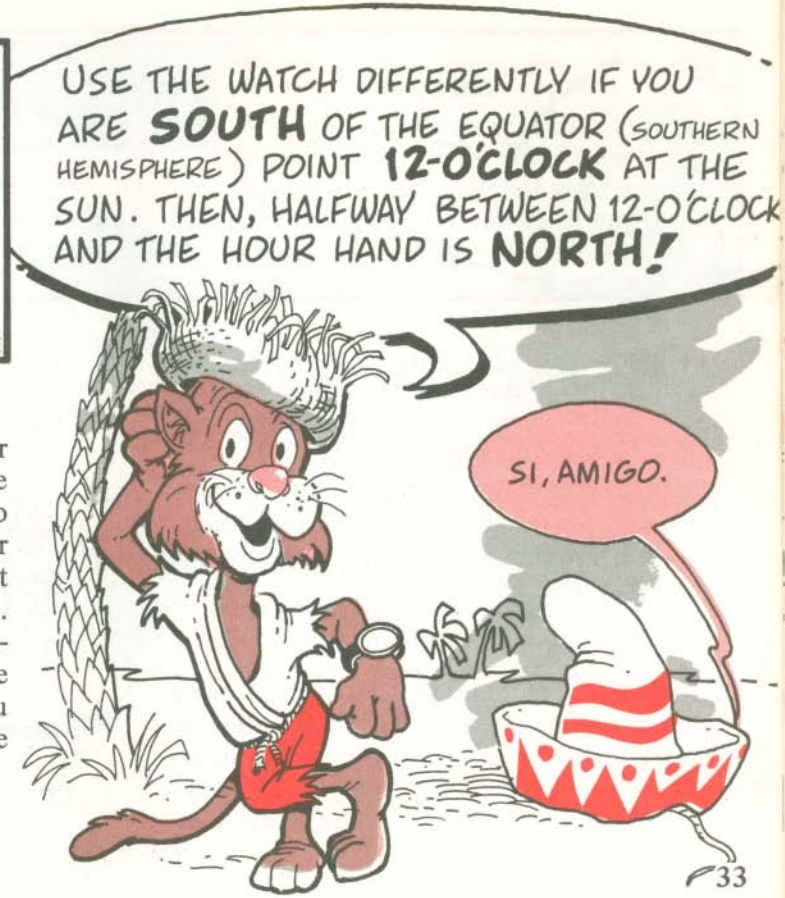
The material on pages 31-33 was adapted from the book, Better Ways of Pathfinding, published by Stackpole Co., Harrisburg, Penn, copyrighted © 1964 by Robert S. Owendoff, 11156 Byrd Drive, Fairfax, Va. All rights reserved by copyright owner (author).

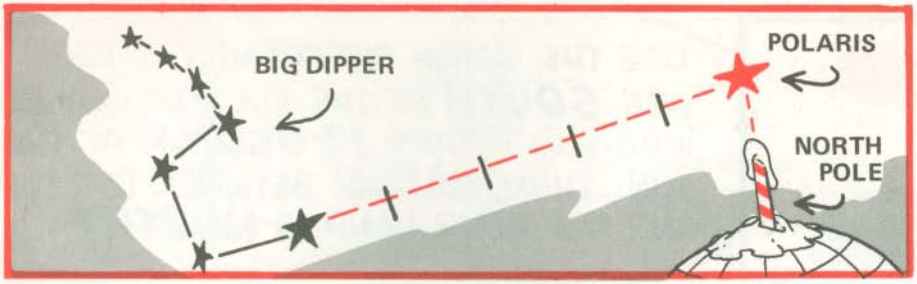
Well, since the sun always rises in the east and sets in the west, the shadow tip moves in just the opposite direction. So the first shadow tip mark you make is always WEST, and the second mark is always EAST.

REMEMBER: Place your stick vertically into the ground. Mark the tip of each shadow. The first tip is the WESTERN half of your line, and the second tip is the EASTERN half. You can draw a NORTH-SOUTH line perpendicular to your EAST-WEST line.



You can also find direction with your watch. It's not as accurate as the SHADOW-TIP method, but it will do in a pinch. North of the equator (northern hemisphere), this is how it works. Point the hour hand at the sun. Then, SOUTH will be half way between the hour hand and twelve o'clock. Try this in a place where you already know the directions to prove that it works.





At night, you can locate north by finding the north star (POLARIS). First, find the Big Dipper. The last two stars in the cup point directly at Polaris, which is about 5 times as far out as the distance between those 2 stars in the cup. Facing Polaris you are looking north, with east on your right and west on your left.

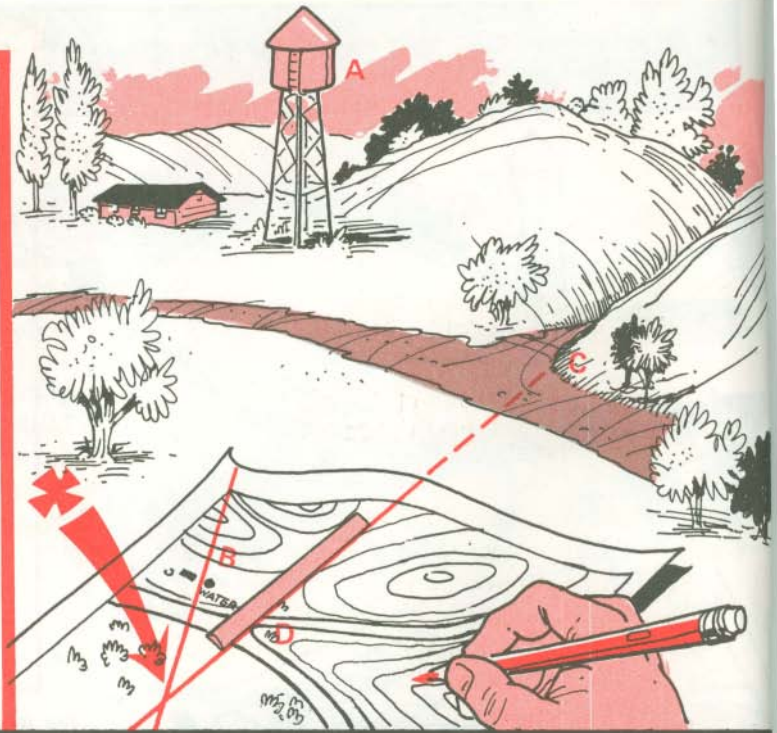
Once you are able to find north (using your compass, the sun, or the stars), you are then ready to locate your position on your map. There are many good ways that you can use to locate your position on your map, but first you have to do one important thing.

You've got to point your map so that NORTH, SOUTH, EAST and WEST on the map POINT THE SAME WAY as they do ON THE GROUND.

LOCATING YOUR POSITION

What if you want to locate your position but don't know exactly where you are? Orient your map as closely as you can using one of the ways you've learned about finding direction—compass, sun watch, or stars. Then, look for some feature—like a water tower (A)—that you can also find on the map. Put a ruler or straightedge on the map, and place its edge right next to the water tower symbol (B) on the map. Then aline the straightedge so that it points exactly at the real water tower. Draw a line along the ruler (the line will cross the symbol for the water tower on your map).

Next, find another feature–like a road junction, and do the same thing. Lay the straight-edge on your map and point it at the real road junction (C), while at the same time its edge crosses over the road junction (D) on the map. Draw another line along the ruler until it crosses (intersects) the first line. The point where the lines cross is your location (X). This is called RESECTION. If you do the same thing with a third line, it may help locate your position more accurately.

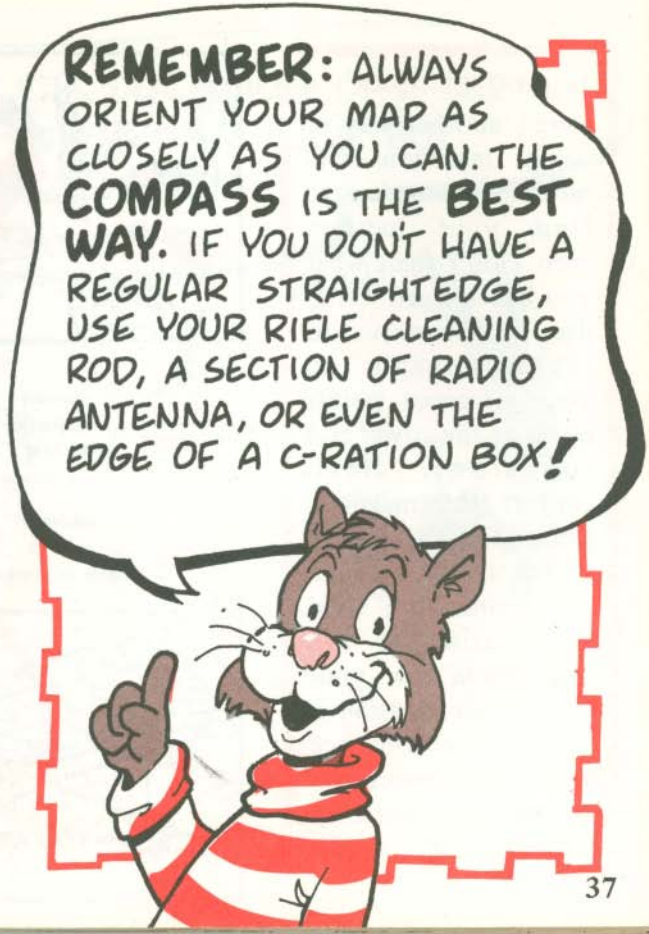


REMEMBER: Don't move your map once you've got it properly oriented.

If you know that you are located somewhere along a certain linear feature on the map (such as a road or river bank), then you can use an easier method to pinpoint your location—a method called MODIFIED RESECTION.

MODIFIED RESECTION

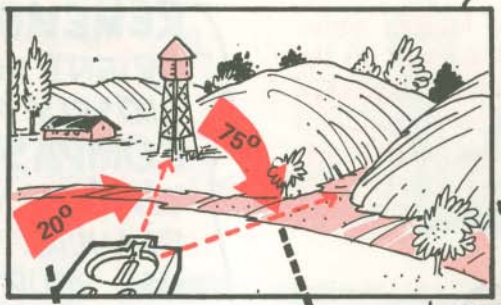
First orient your map, then find some feature that you can also find on the map, such as the water tower in the previous example. Just like before, put a straightedge through the water tower on the map and aline the straightedge so that it points exactly at the real water tower. Draw a line along the ruler. The point where the line crosses the linear feature which you know you are on (road, river bank, etc.) is your location.



ANOTHER WAY

Here's another way of using resection and modified resection to find your location even closer than what you just learned. First, use your compass to shoot azimuths to your reference points (such as the tower and junction). Next, convert the magnetic azimuths to grid azimuths, then determine the grid back azimuths and plot them on your map. Your location is where these grid back azimuths intersect.

GM angle = 9° (p. 22)



20°
+9
29°

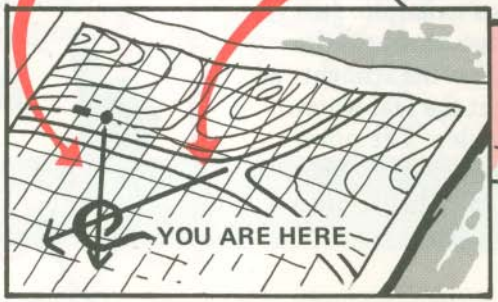
convert magnetic to grid

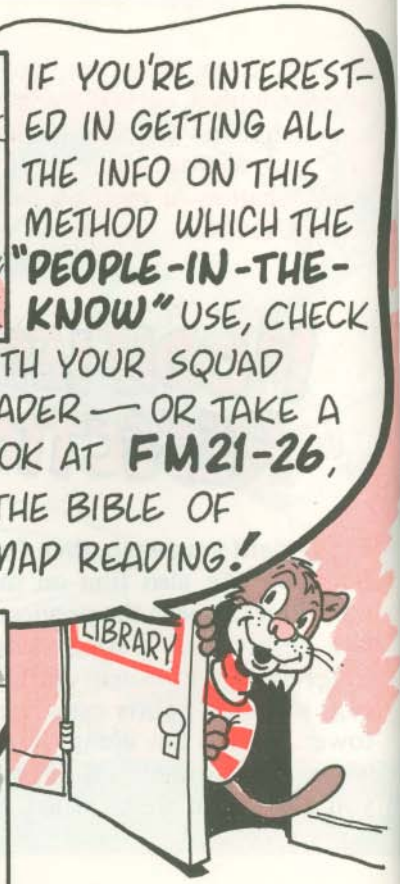
75°
+9
84°

29°
+180
209°

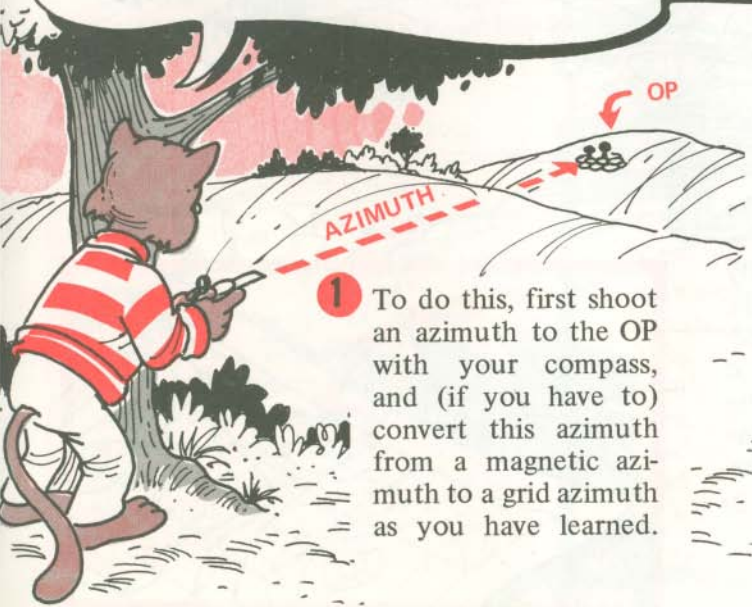
convert grid to back azimuths

84°
+180
264°



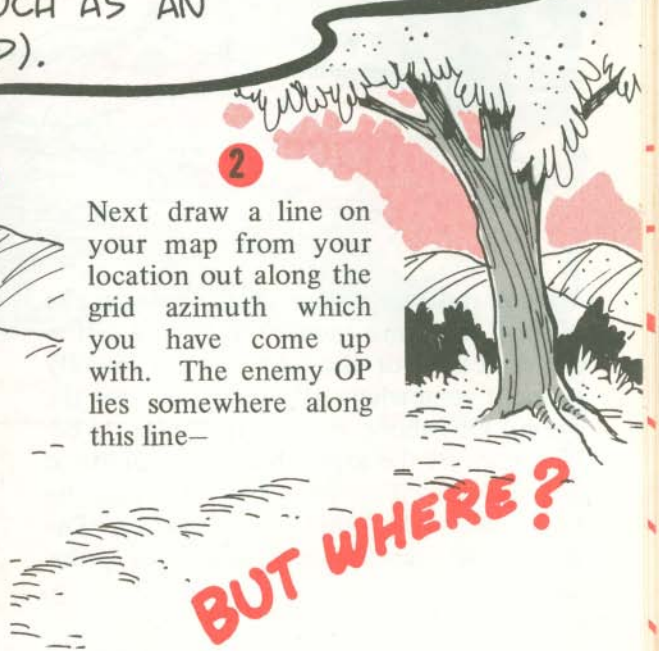


SUPPOSE YOU WANT TO KNOW THE **LOCATION** OF A CERTAIN OBJECT WHICH YOU CAN **SEE** IN THE DISTANCE BUT IS **NOT ON YOUR MAP** — SUCH AS AN ENEMY OBSERVATION POST (OP).

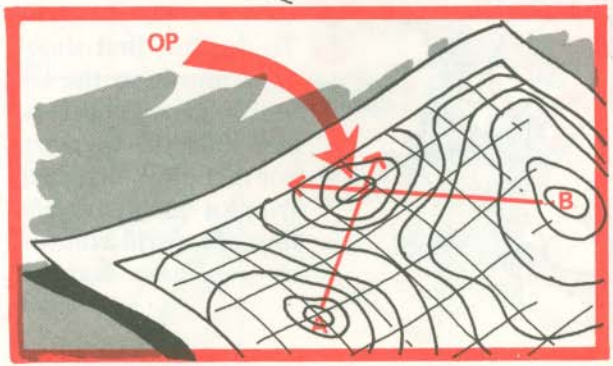


1 To do this, first shoot an azimuth to the OP with your compass, and (if you have to) convert this azimuth from a magnetic azimuth to a grid azimuth as you have learned.

2 Next draw a line on your map from your location out along the grid azimuth which you have come up with. The enemy OP lies somewhere along this line—



To find out, move yourself so that you can observe the same enemy OP from a different direction, or else have another friendly element somewhere else (who also sees the enemy OP) shoot an azimuth to it. As before, convert the azimuth from magnetic to grid and draw it on your map (out from the point where the azimuth was taken). The enemy OP also lies somewhere along this line—



RIGHT!

Where the second line intersects with the first line is the location of the enemy OP. You have just used a method called INTERSECTION. You can now call artillery or mortar fire on the enemy position which you have pinpointed.

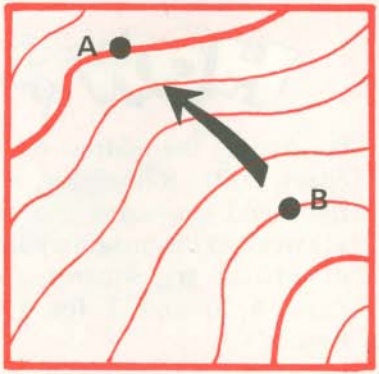
HOW?

By reading the address of the enemy OP. Remember, read right and up, using the grid squares and the imaginary lines in between grid squares. (See Pages 5, 6 and 7 for a refresher.)

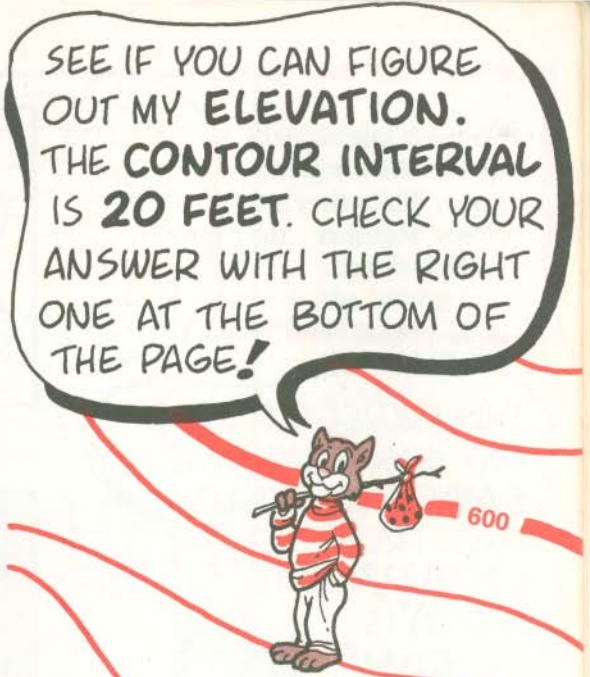
Your military map shows something important that ordinary maps don't have. That is elevation (relief)—the slopes, hills, and valleys. You have already learned about locating points, measuring distances, and finding the right direction. But you should also check hills and valleys along the direction you intend to travel before you start. **IT MIGHT SAVE YOU SOME TROUBLE!**

...and this is about CONTOUR LINES

The brown lines on the map are called CONTOUR lines. Each line shows the height above sea level. Contour lines never cross one another. Printed at the bottom of the map is the CONTOUR INTERVAL, which is the difference in height (elevation) between one brown line and the one next to it. On a map with a scale of 1:50,000 contour interval is usually 20 feet. This would make point "A" 80 feet higher or lower than point "B."

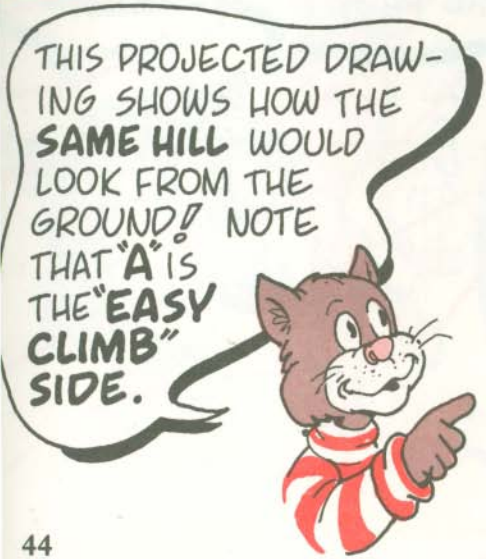


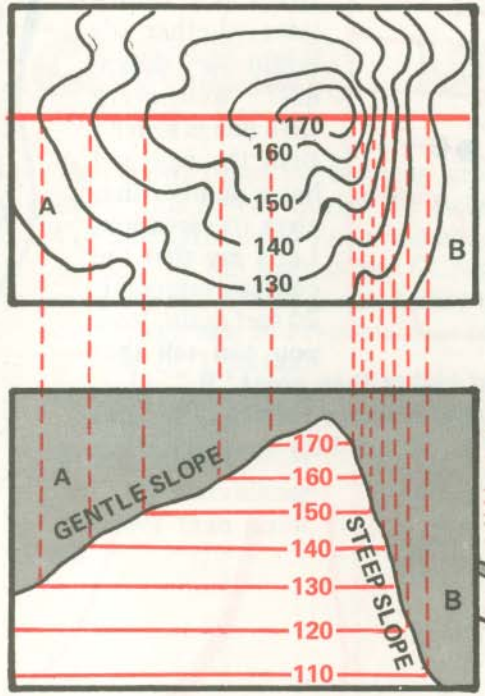
How can you tell from the brown lines whether it's uphill or downhill? Well, every fifth line is heavier than the rest and has a number that gives its elevation. Let's say that the contour interval is 20 feet again. Now you can tell that point "A" is 80 feet higher than point "B." Also, if you knew the ground distance between "A" and "B," you could get an idea of how steep the slope was.

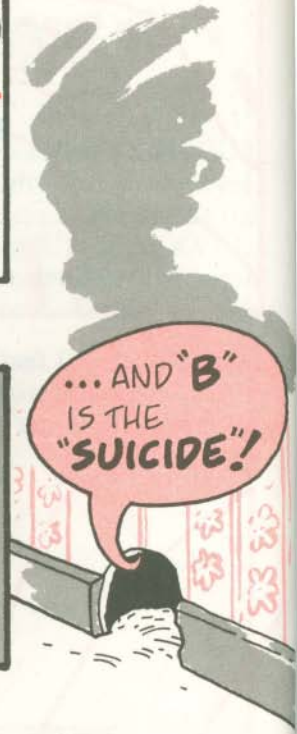


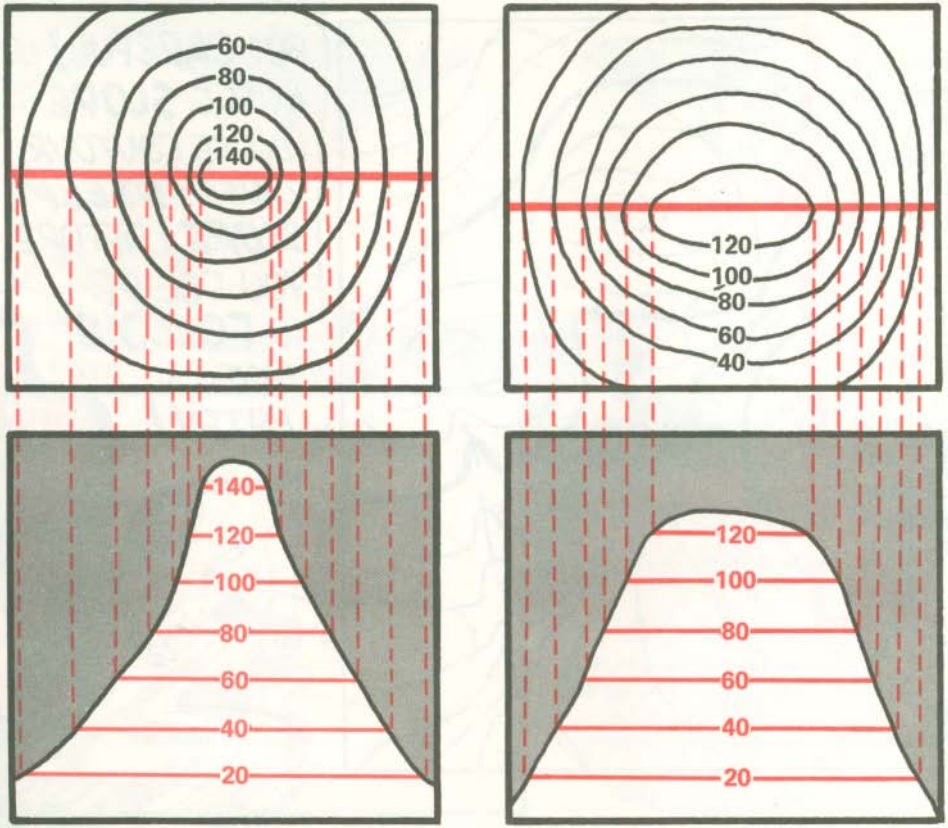
ANSWER: 560 feet.

Contour lines widely spaced show a gentle slope. When they are close together the slope is steep.





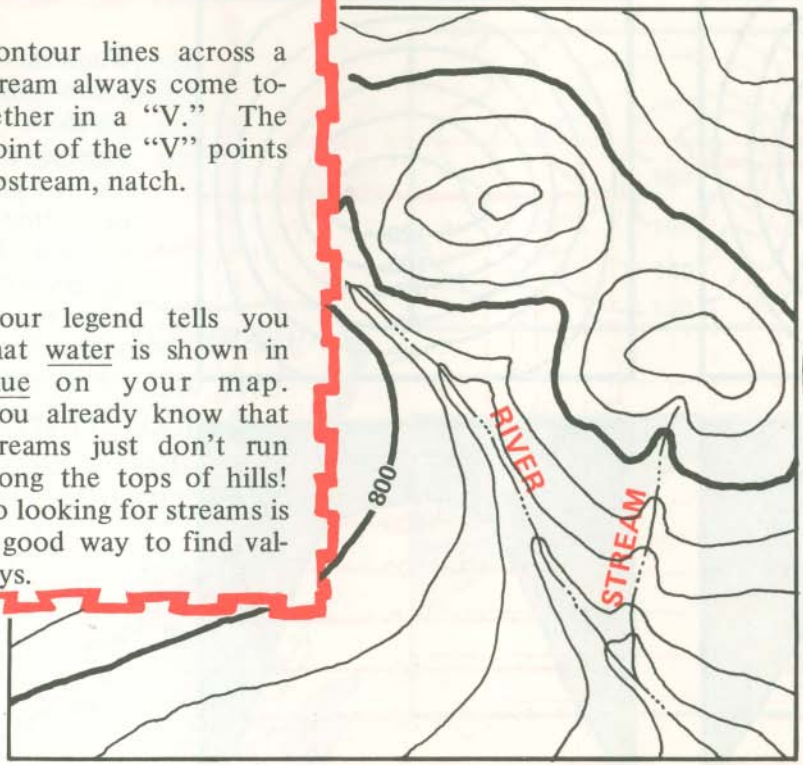




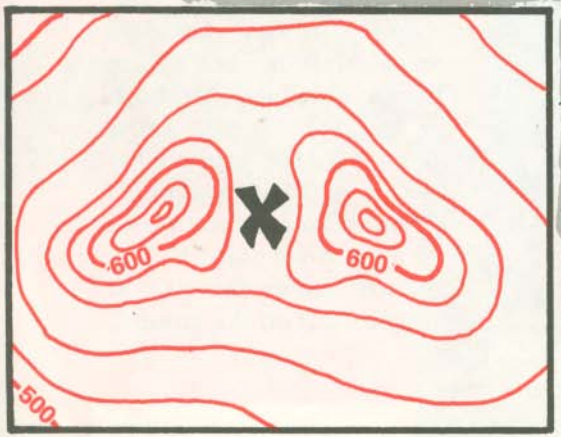
When the contour lines are close together at the top of a hill, the hilltop is pointed. The hilltop is flat when the contour lines are widely spaced at the top.

Contour lines across a stream always come together in a "V." The point of the "V" points upstream, natch.

Your legend tells you that water is shown in blue on your map. You already know that streams just don't run along the tops of hills! So looking for streams is a good way to find valleys.

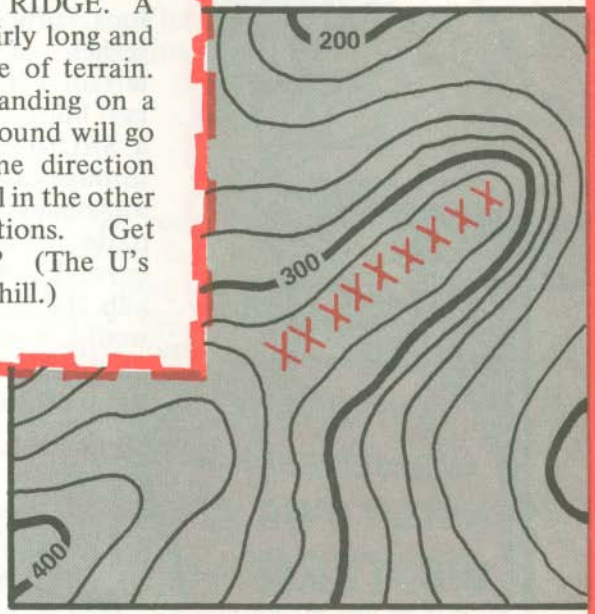


Sometimes contour lines show two hilltops fairly close together. The lower terrain between the two hilltops is called a SADDLE. Going through a saddle is sometimes the easiest route to use to get beyond the two hills. Of course, you wouldn't go through a saddle if the enemy was on the hills.

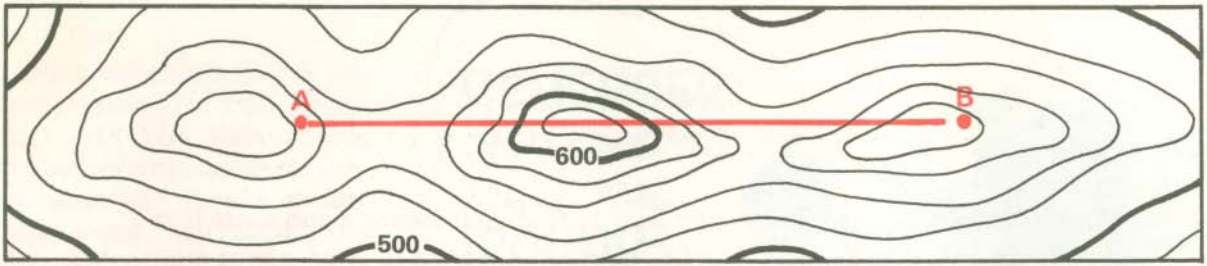


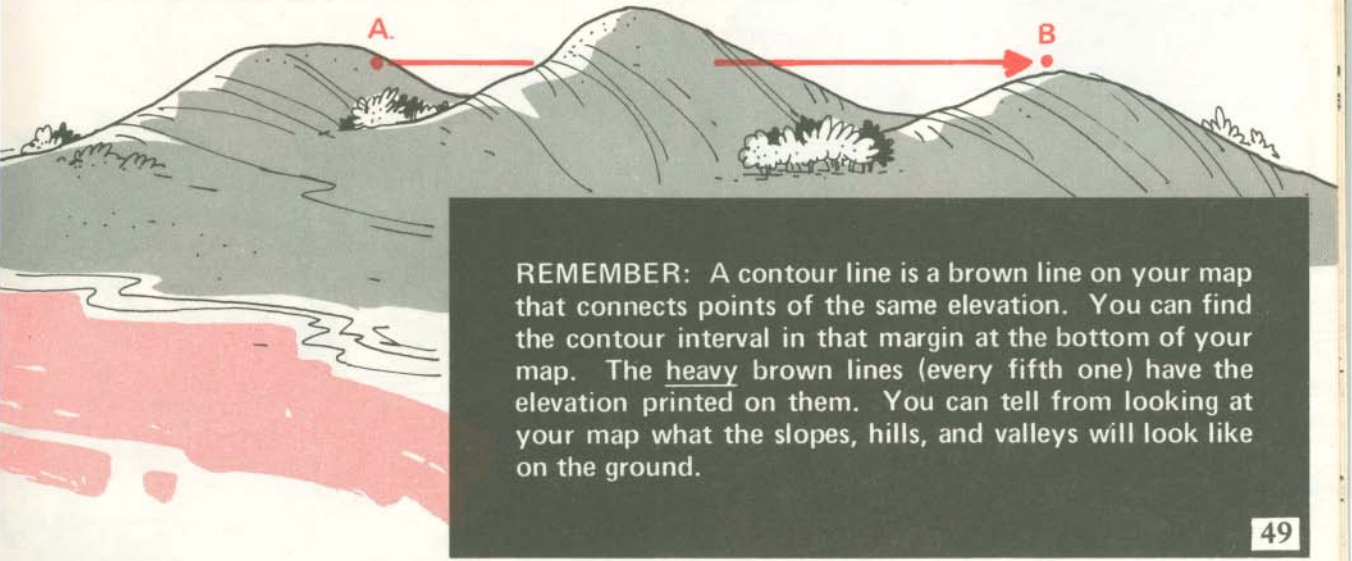
IF IT WAS IN CALIFORNIA — WOULD IT BE A **WESTERN SADDLE?**

Another terrain feature that you should know about is the RIDGE. A ridge is a fairly long and narrow piece of terrain. If you're standing on a ridge, the ground will go uphill in one direction and downhill in the other three directions. Get the picture? (The U's point downhill.)



You can use contour lines to tell whether or not you will be able to see from one point to another. For example, you know you are at point A and you want to see what's going on at point B. Draw a line from A to B on your map. Note that it crosses some contour lines with a higher elevation than both A and B. So you know there's higher ground between point A and point B, and therefore you won't be able to see point B. The picture shows this as you would see it on the ground.

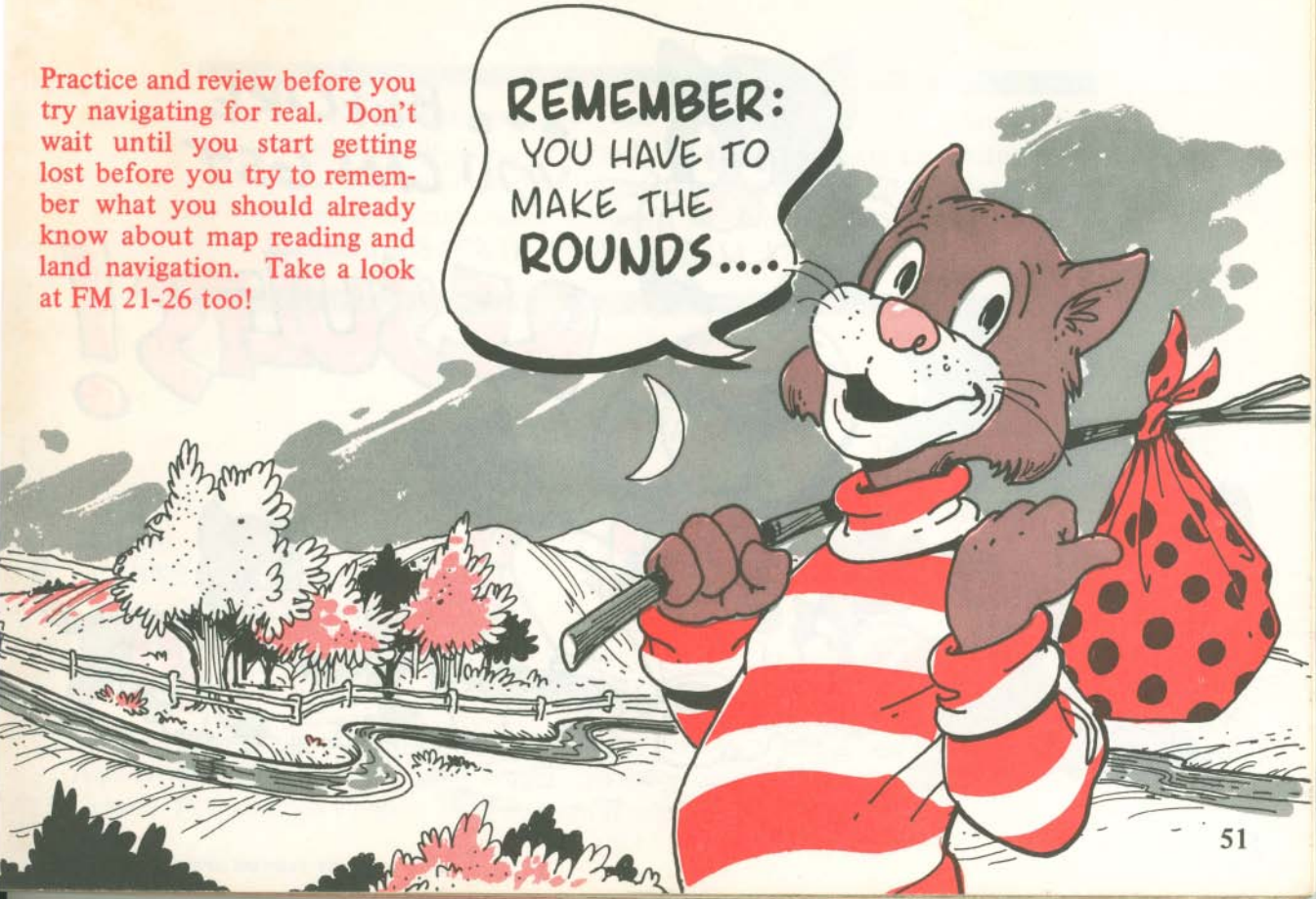


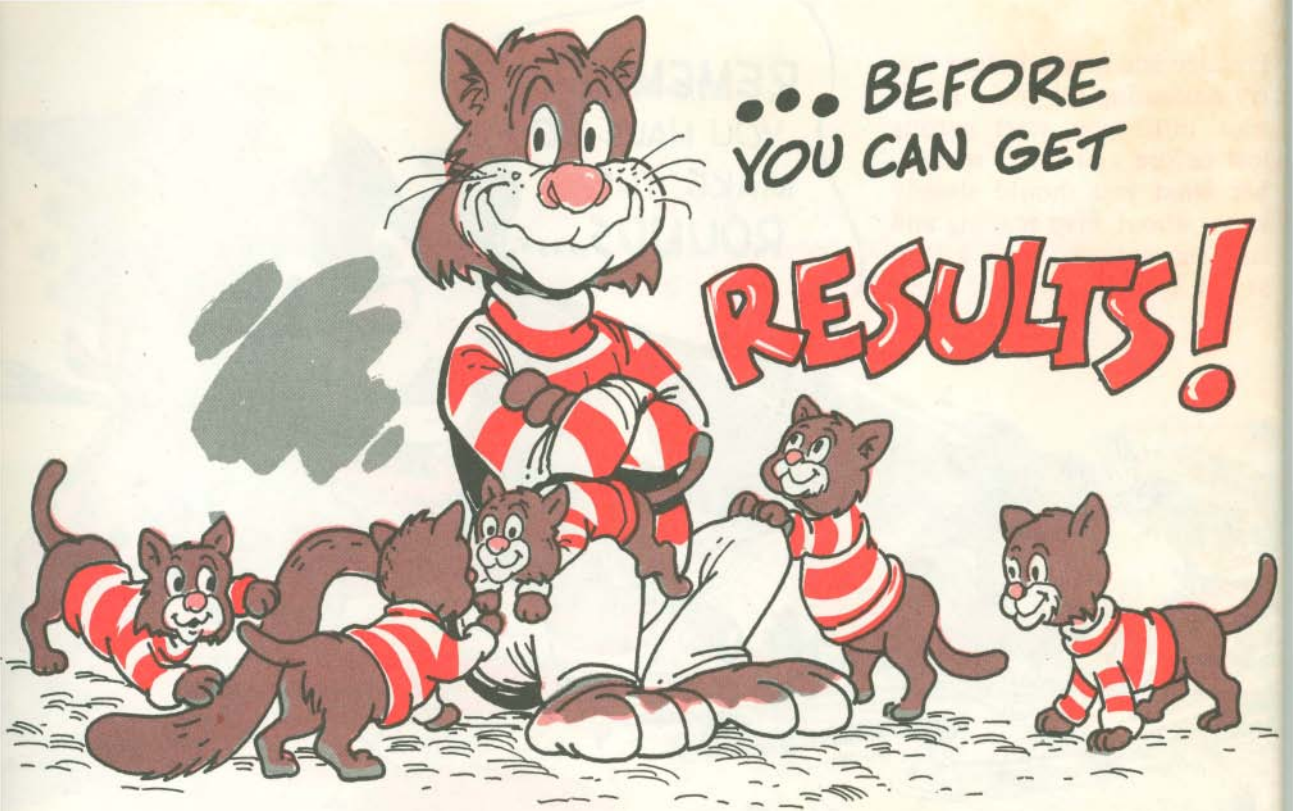


REMEMBER: A contour line is a brown line on your map that connects points of the same elevation. You can find the contour interval in that margin at the bottom of your map. The heavy brown lines (every fifth one) have the elevation printed on them. You can tell from looking at your map what the slopes, hills, and valleys will look like on the ground.

THIS booklet has shown you how to find your location and write it as 6-number coordinates. It tells you what you need to know about measuring distance, finding directions, and reading contour lines. You won't get lost if you use this information.

Practice and review before you try navigating for real. Don't wait until you start getting lost before you try to remember what you should already know about map reading and land navigation. Take a look at FM 21-26 too!





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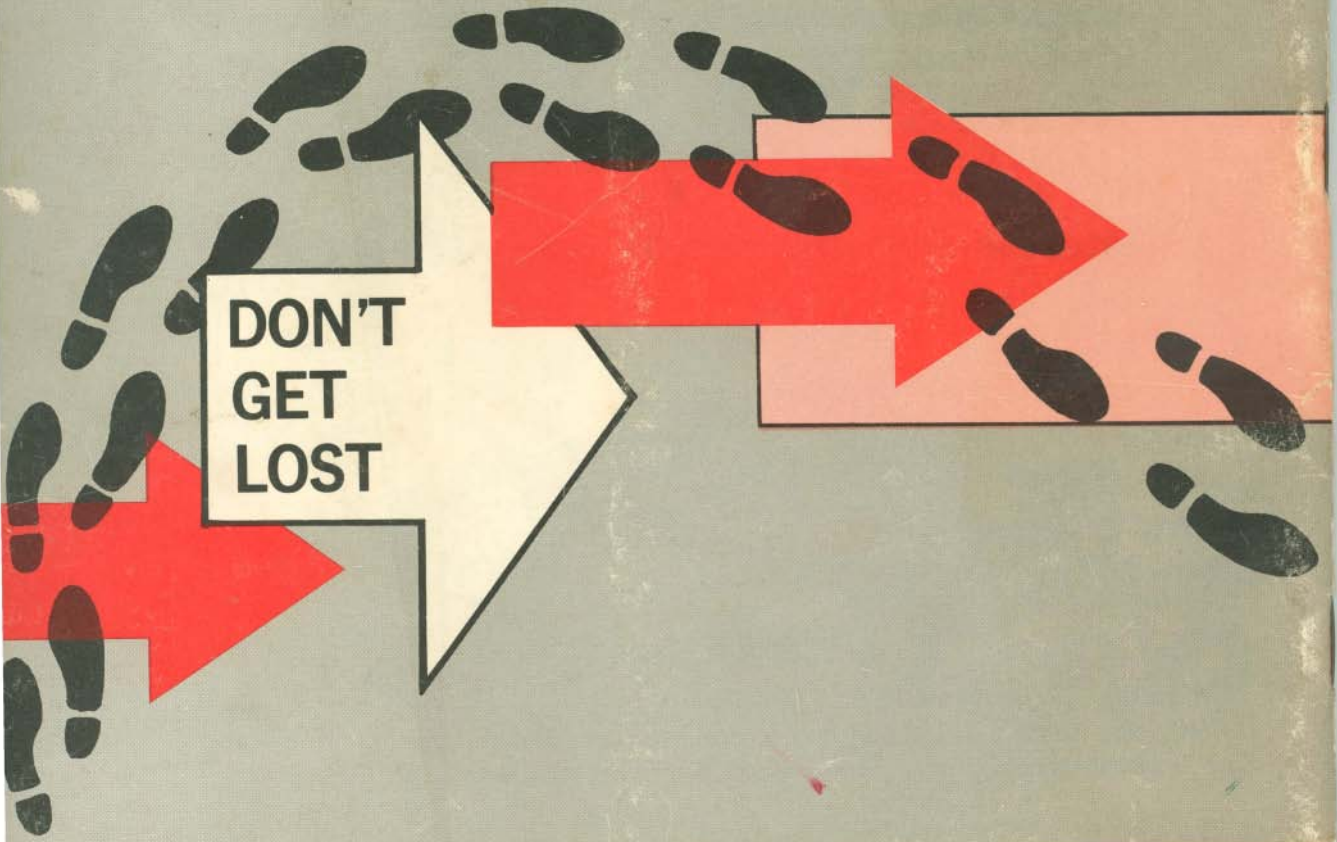
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